SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1815.—Vol. XL. LONDON, SATURDAY, JUNE 4, 1870. {STAMPED .. SIXPENCE. UNSTAMPED. FIVEPENCE

Original Correspondence.

THE BLAENAVON IRON AND STEEL COMPANY.

Under the above title the public are invited to participate in raising a capital of 600,000*l.*, for the purpose of taking over the leasehold and freehold mineral property, together with the blast-furnaces, forges, mills, &c., at present, and for many years past, held by the Blaenavon Iron and Coal Company.

The works forming the estate, now offered to the public for the sum of 510,300*l.*, have a history of which a brief sketch may at the present juncture be acceptable to some of our readers. Circumstances in connection with them, both griefs and triumphs, have at various times been recorded in the *Mining Journal;* we only, therefore, discharge a duty incumbent upon us as journalists in endeavouring to give the public the benefit of whatever information it may happen to be in our power to impart in reference to so important an undertaking, and that as impartially and faithfully as possible. The origin of the Blaenavon Iron Works seems to have been the erection of three blast-furnaces by THOS. HILL and Co., in the year 1790, and they continued in the hands of the same proprietary and their successors until 1836, when the estate was sold by the then proprietors (Messrs. THOS. HILL and WALDRON HILL) to several gentlemen, of whom the recently deceased Mr. R. W. KENNARD was one, and by whom the first Blaenavon Iron and Coal Company was established, under a Deed of Settlement dated June 8, 1838, the capital being 400,000*l.*, in 8000 shares of 50*l.* each. After paying the purchase money, and the expenses incidental to the formation of the company, a very handsome sum remained to be called up. Like many similar undertakings, it was not long before the capital was exhausted; in this instance it was by an untimely and, on that account, injudicious outlay upon new works, that remained unfinished for more than 25 years, placing the company in a position to be obliged to carry on, cramped for capital, through times that ought to have yielded a handsome return to the shareholders.

Thus while several of the great ironmasters of Monmouthshire made colossal fortunes, the Blaenavon Company managed (or rather may be said mismanaged by a board of directors in London) to swindle its capital away, until in 1853 and following years the shareholders became extremely dissatisfied. Stormy meetings and committees of investigation were held, followed by conspiracies, some genuine, others got up by adventurers with the object of "ousting" the directors, terminating in fruitless expense, and no advantages to the company; these proceedings were, however, followed by certain changes that have doubtless gradually led to the present improved condition of the company. The board of directors was reconstructed in 1856, and the management at the works changed in 1857, at the end of which year commenced one of the longest periods of depression in the iron trade; nevertheless, in view of better times, the revolution so much required, and an extensive remodelling of the works was commenced, and actively carried on during the succeeding five years, the new forge and mills (recommended by a shareholders' committee in 1853, and otherwise frequently pressed upon the directors) were commenced in 1858, and were started at intervals during the two succeeding years; from *four*, the number of furnaces in blast was increased to *six;* locomotive roads and engine power—superseding animal power—was introduced to the utmost practicable extent. The patent Tyre Mill line, so important a feature at the works, was finished in 1861, and is, no doubt, a source of considerable profit to the company. In 1862, the board of directors was again reconstructed under circumstances unlikely to be favourable to the interests of any company, and, consequently, a change in the works management followed in 1863, since which time the new works commenced in 1838, consisting of *three* blast-furnaces, have been finished and put in blast, materially enlarging the producing power of the works, placing the company in a position that it might, and no doubt would, have attained many years earlier had the power of management been less in the hands of directors sitting in London, and more, as it should have been, in the hands of the responsible but too often powerless manager of the works.

That the property is of great value is well known to all who are acquainted with the district; the minerals are of most excellent quality, and the lease under which it is held is undoubtedly a favourable one. With these advantages, all needful outlay made, and the fair prospects of good times ahead, it seems only to require judicious handling to secure for the new iron and steel company a prosperous career equal to, if not surpassing, any similar undertaking.

THE DUNKIRK COLLIERIES.

These collieries, situated near Dukinfield, in Cheshire, are on the property of Mr. Astley, and carried on by the Dunkirk Coal Company. The royalty is extensive, and coal is raised from three different plants—at the Astley pits, where about 550 tons per day are raised; the Dewsnap pit, where 250 tons are raised; and the Chapel pit, where about 250 tons are raised daily. The principal plant is the Astley pits, which are well known as being—until the recent opening of Rosebridge shafts—the deepest coal pits in Great Britain. There are two pits, about 30 yards apart, one downcast, one upcast, both sunk a little below the Black Mine, which is again reached by a short tunnel from the downcast. A sump, 12 yards in depth below this, makes the total depth of the pit from the surface [illegible] yards.

The machinery at the Astley pits comprises the winding-engine at the downcast, one 60-inch vertical cylinder, 7-feet stroke, direct acting and condensing, 18 lbs. steam pressure, two 24-feet flat wire-rope drums; when all the rope is wound on the diameter is 28 feet. The valves are worked by two eccentrics, and a hand lever, movable horizontally. The air-pump is worked from a strong beam in connection with the parallel motion. The engine is constructed chiefly of cast-iron, and was made in Manchester in 1850, by W. Fairbairn and Sons. The wire-ropes are six-stranded, charcoal wire, and tapered, being 3¾ inch at the outer end, and 4¼ inch at the inner end [illegible] inch. Behind the engine a pit is sunk 100 yards in depth, in which the counterbalance chain, attached to a four-linked chain on the drum-shaft, acts by its weight in starting the engine, acting against the engine as the loaded cage rises to the surface. Four 8 cwts. tubs are raised in each cage; on two decks the cages are guided each by two wood conductors.

Part of the downcast is appropriated for the pumps, being divided from the drawing-shaft by stempels only. The pumping-engine is a 70-inch cylinder, 8-feet stroke, furnished with cross-head, connecting-rods, and side-levers, the pump-rods are attached to the end of the levers. The steam is applied and condensed on the Cornish principle, at 30 lbs. pressure. Water is raised in seven lifts from the depth of 686 yards, all of which are plunger lifts, and 8-ft. stroke. The lowest is 6 inches, the sixth 7 inches, the fifth 9 inches, the four upper lifts are 12 inches in diameter, the top one delivering at the surface. The engine goes day and night at the rate of five strokes per minute. A balance-beam at the top of the pit, with 28 tons of weight, assists the engine in its up stroke in raising this immense length of rods.

The winding-engine at the upcast pit has one 48-inch vertical cylinder, 6-ft. stroke, direct-acting, non-condensing. The valves are worked by two cranks, vertical rods, tappets, and a hand lever, which may be shifted horizontally. There are two flat wire-rope drums, 16 ft. in diameter. Coal is raised from the Town Lane seam, the depth of which is 410 yards. Two 8-cwt. tubs are raised in each cage on one deck. The cages are guided each by two wood conductors. Safety-catches are not applied to the cages in either of the Astley pits. There are four Lancashire boilers to each winding-engine, and three similar boilers for the pumping-engine; these are placed under cover in the space between the winding-engines.

An 18-inch horizontal engine is fixed near the downcast pit to work a system of endless chains; this engine can also be attached to a capstan when required. There are three endless chains kept in motion all the day; one 500 yards in length conveys tubs laden and empty to and from the Peak Forest Canal. Another raises Cannel from the bottom of the screens to the pit platform, and a third, which is worked by an intermediate horizontal shaft and bevel wheels, raises coal and Cannel from the platform to be stocked. At the downcast pit the Black Mine and Cannel are raised. The Cannel is separated by three screens into three classes—large, nuts, and small. The coal is separated underground as large and slack, and is tipped into the railway trucks, canal boats, or carts, as required. There is a large local demand for coal, particularly at the Chapel pit, most of which is conveyed away by carts to Dukinfield, Ashton, and Staleybridge. The Black Mine, as worked in the downcast pit, is as follows:—

	Ft.	In.
Strong metal roof.		
Soft shale	1	6
Coal	4	0
Underclay.		

The south levels are driven 1600 yards to the boundary from the pits, and the north levels are driven 600 yards. An engine-plane, commencing 100 yards north of the downcast, is driven about 550 yards. The dip is 15 in. per yard at the top, and 12 in. per yard at the lower part. There are north and south branches 400 yards down. The hauling-engine has two 18-inch horizontal cylinders, 4-ft. stroke, on second motion. There are two drums, on two separate shafts; only one is used at present. Another road is being prepared, when journeys will be run up and down at the same time: 12 tubs are run at once; the full ones, after being raised up to the engine, are dropped back to the pit. Two plain boilers are fixed near the engine, and the ventilating furnace is near these; both are supplied with fresh air. The quantity of air in circulation is stated to be:—

In the Black Mine, downbrow	18,000	cubic feet	per minute.
ditto south level	15,000	,,	,,
Town Lane workings	10,000	,,	,,
	43,000	,,	,,
Add for furnace and boilers	9,000	,,	,,
Total	52,000	,,	,,

Under new management, the intakes and returns in this and the Cannel mines are being enlarged, and a considerable increase in quantity of air has been obtained. The question of safety should be the first object to be attained in all colliery workings, as accidents are known to entail heavy loss on proprietors, and damage the character of a mine for years. The truest economy is, no doubt, to arrange the works so that good ventilation is obtained, its distribution to every part of the mine effected, and accumulations of gas will thus be avoided. In driving out levels in the Black Mine, counter, main, and dip levels are driven: the main level is 4 yards in width, the others 2 yards. The rank levels are 4 yards wide, and 16 yards to 20 yards apart. After the latter are driven the pillars are worked back on the end. It is not a rule here to work always to the boundaries before commencing the wide work, as the wide work is sometimes advantageously carried on whilst the levels are still driving out. Lamps are used in this mine; powder is not used for the coal, only in blasting stone on the roads. The Cannel is got by driving tunnels to the east out of the Black Mine, both in the levels south of the pits and in the south levels, 400 yards down the brow; there are two tunnels from the latter, 190 yards in length. The Cannel and Black Mine are comparatively little worked, particularly to the dip of Astley Pits.

SECTION OF CANNEL—	Ft.	In.	
Good roof.			
Cannel	2	6	
Coal	0	3	=2 ft. 9 in.
Bass and coal	1	0	
Grey metal.			

Lamps are used in the Cannel workings; powder is used only for stonework on the roads. The Cannel is holed at the top; the roof being strong, the immense pressure from underneath lifts it up. This mine is worked by the long wall to the rise. The jig-brows are 120 yards to 200 yards apart; the levels out of these, 25 yards apart, formed in the goaf. The stall-roads, called tin-brows, are 15 yards apart. In each tin-brow the Cannel runs down on sheet-iron into a tub at the bottom, whence it is taken to the jig-brow. One jig-brow is supplied from two or more levels, by applying a loose rope for each level; a flat landing and loose rails are also required at the end of each level. The goaf is filled up, principally with the cutting of the bottom, &c. By the long wall method of working, direct from the main and counter levels, the preliminary work of driving jig-brows, levels in ranks, and then wide bays, is all avoided, and generally larger coal is obtained. The temperature at the end of the lower south levels in the Cannel was stated to be 80°, but 90° would be about the normal temperature of the strata. Since the introduction of more air, the temperature has been reduced to 74° at the same point. The depth from the surface will be there about 820 yards. The increase in temperature of the strata is in accordance with the depth from the surface, but this normal temperature is modified by the passage of strong currents of air, especially those having short runs. The introduction of fresh air in large volumes can alone counteract the high natural temperature of deep workings. The Town Lane Mine is worked from the Astley upcast pit.

SECTION OF SEAM—	Ft.	In.
Top coal	1	0
Shale band	0	4
Bottom coal	2	9

The coal is worked direct from the levels on the long wall system; it produces little gas, and candles are used throughout the workings. The north levels are driven 1100 yards to the boundary, two small faults are crossed; the south levels are driven 1300 yards, and three faults are crossed.

The Great Mine and Roger Mine are each worked in the Dewsnap and Chapel pits. The Roger Mine lies a great distance above the Town Lane seam, the Great Mine lies about 30 yards above the Roger Mine. These two seams are, or should be, worked in conjunction, the Great Mine a little in advance of the other. The Great Mine is worked to the boundaries on both sides, and the pillars are being worked back. Jig-brows are 200 yards apart, ranks 15 to 20 yards. A strong barrier is left against old works to the rise in both mines. The Roger Mine levels extend to the boundaries; the main and rank levels are 2 yards wide, the latter 20 yards apart, coal worked back on end. Jig brows 200 yards apart.

The Dewsnap pit—to the dip of Astley pits—is the upcast for its own and the Chapel pit workings. The pit is 226 yards in depth to the Great Mine. Winding engine, one 31-in. vertical cylinder, 5-ft. stroke, direct-acting, two eccentrics. Three plain boilers, 40 lbs. steam pressure. Two flat wire-rope drums, 15 ft. in diameter. Each cage carries two 8-cwt. tubs on two decks; these cages are fitted with Owen's catches. A hauling-engine is fixed near the bottom of the pit, having two 18-in. horizontal cylinders, 4-ft. stroke, on second motion; two drums on separate shafts. There are two downbrows, one 560 yards, and the other 360 yards in length; the drums are proportioned to the length of roads. There are three boilers built close to the engine. The Chapel Coal pit is 1100 yards north from Dewsnap pit; it is 300 yards in depth to the Great Mine. Winding-engine, one 30-in. vertical cylinder, 5-ft. stroke, valves worked by two cranks. Two flat wire-rope drums; each cage carries two tubs on two decks—Owen's catches applied to them. Three Lancashire boilers, high pressure steam used.

The pumping shaft is about 100 yards distant from the coal pit. A 70-inch Cornish beam-engine is erected, 10-ft. stroke, equal beam, steam pressure 30 lbs., used expansively. There are five boilers, four Cornish and one Galloway. Water is raised in five lifts, from the depth of 300 yards; the lowest is a 15-inch bucket lift, the other four are plunger lifts, and each 15 inches in diameter. This engine is kept going day and night. An underground engine, near the bottom of this pit, for hauling and pumping has two 25-in. horizontal cylinders, 4-ft. stroke, two drums, one at work, downbrow 300 yards in length in the Roger Mine; it raises water from the downbrow in two lifts, one bucket 9 in. at bottom, one plunger 9 in. at top: 2-in. iron rods run on rollers, pumps day and night. There are two Lancashire boilers on the surface to supply this engine. High pressure steam is conveyed down the pump-shaft in pipes; the exhaust is brought up the same, also in pipes, and discharges into the chimney attached to the boilers. The heat of these pipes causes the shaft to be an upcast.

The Dunkirk Coal Company do not adhere altogether to the system of driving out the main levels first to the boundaries and working back towards the pit; but in many cases this system is carried out. Where safety-lamps are in use in the mines powder is not used: it would have been well had this commendable regulation been generally adopted in the neighbouring county of Lancashire. An immunity from explosions of gas, if not secured by adequate ventilation, would have been obtained in most instances by the avoidance of shot firing, as most of the explosions are traced to the practice of firing shots in the neighbourhood of accumulations of gas.

PREVENTION OF COLLIERY ACCIDENTS—No. IV.

SIR,—In continuing my subject, the present portion will be devoted to a description of guides, conductors, or slides, for by such names are they designated; the last being wrongly applied, as they should rather be called the slide-bars, the portions of the cage working on them being the slides. Before the introduction of conductors the minerals were raised in the shafts by means of skips, bowkes, or corves. Skips are square or round platforms of timber, fixed on four wheels, having a strong bar of wrought-iron bent over the top, in which the hook on the end of the chain or rope is placed for lifting. There are also four rings of iron, placed at equal distances, through which lashing chains pass, and are fastened to the hook, for extra precaution. The coal or ironstone, or whatever it may be, is kept on these skips by means of broad hoops of wrought-iron, placed one above the other over the bent bar of iron. The skip is more commonly used now in South Staffordshire than the tubs and cages,—which I shall afterwards explain, some being greatly in favour of them, which the following remark from a butty collier will prove. He said, during a discussion that was going on as to the merits and demerits of the conductor and cage system, that it was not possible to get the thick coal from the pits as it should be got in tubs, and that a skip was necessary, for it had to be broken up in small pieces to be put in the tub, and so made a quantity of extra slack down the pit; while in a skip the coal can be piled in very large lumps, in some instances 30 cwts. each. This is certainly an advantage, but I shall show that the many gained by using the tub greatly preponderate. Bowkes are square boxes when made of wood, but round when constructed of iron, with a bent bar of iron to suspend it to the lifting hook. Corves are wicker baskets, made in a similar way to the bowkes, and were formerly used in the North. Both the bowkes and corves are made without wheels, so that they have to be placed on sledges or trolleys to be moved about. Bowkes are now used for sinking in South Staffordshire. The articles of conveyance I have described are all made to hang, attached to a chain or rope, loose in the shaft, so that it will be clearly seen they would not answer for quick winding; they also do a great deal of damage to the sides of the shafts by swinging against them. It will also be imagined that they are not a very safe or comfortable means for raising or lowering men, who have to use their hands to keep themselves from hurt, by being knocked against the sides of the shafts. To overcome these

difficulties conductors were introduced. They are constructed either of wood, iron, or wire-rope; the former are most in favour, and are made of pine, 4 by 3 inches, placed up each side of the shaft, and fixed at intervals to byats, or cross stays, let into the brickwork of the shafts. Those of iron are generally rails, fixed in a similar way to the wooden ones; but there are instances where a round bar of iron is continued from the top of the pit to the bottom, on which work rings fastened to the cages. The conductors, made of wire-rope, are fixed to wooden frames at the top and bottom of the pit by means of screws, which are drawn up perfectly tight, to prevent the ropes from vibrating. I have seen good and cheap conductors made in this way, using the worn out winding ropes. The wood conductors are the best, for various reasons; when any part of them is worn it is easily taken out and replaced; they work much easier, with less jar and friction; and being soft, they make safety apparatus for the prevention of accidents by the breaking of the rope more effective, as they are easier to grip. Conductors are placed generally two in a shaft, with the exception of where two cages work in one shaft, when there are four. The system of working two cages in one shaft is a very bad one, as many accidents occur by the cages getting jammed together, or coming out of their places, and causing a collision, so as to block up the shaft, and prevent the egress of the men from the pit; but it is now made compulsory by Act of Parliament that two shafts, or ways of escape in case of accident, shall be provided in all mines. This does not prevent the immediate result of the accidents which may occur by working two cages in the one shaft, should men be ascending or descending.

Cages, which are necessarily used with conductors, are about the most useful articles introduced into modern mining. Without them what is now considered a moderate speed of travelling up and down the pit shafts cannot be attained; and instead of having to hang on for your life, and being swung about in that dark abyss a pit shaft, you can on a cage ascend or descend a pit with almost the same convenience and comfort as riding in a railway carriage; the sensation, though, is slightly different. With cages the old clumsey runner, which had, with a good amount of labour, to be pushed over the pit mouth for the load to descend upon, and then withdrawn to let down the empty skip, is dispensed with; the bottom of the cage forming, as it were, a portion of the pit top when up, completely covering the mouth of the shaft, and leaving it securely fenced when going up and down. Cages are constructed principally of wrought-iron; the bottom is made of strong wrought bars, placed a short distance apart, and riveted to a strong frame; under it are fixed two pieces of timber, about 6 in. by 4 in. The sides, or what I might call ends, being the parts nearest the conductors, are made of strong wrought-iron bars, placed in the shape of an oblong, having cross bars of the same material going from corner to corner. The two other sides are open, so that the loaded tub can be pulled off at one, and the empty tub pushed on at the other. The top is composed of a wrought-iron plate, either flat or bowed, and is intended to protect the men from any injury they might receive from falling substances. To the four corners of the top are attached the lifting chains. The slides, or shoes, that work on the conductors, are placed on the sides or ends of the cage I have described, one at the bottom and one near the top, on each side; they are made to bevil from top and bottom towards the centre, so as to more easily pass over any lumps or irregularities in the conductors. The cage I have described is a simple and substantial one, suited to carry one tub; but they are made in a variety of ways, according to the ideas of whoever may be the designer. They are also made with two decks, to carry two tubs, and in some few instances four. The great objects to be attained in building them are strength and lightness; cages made of steel have been found to surpass wrought-iron in those respects. At the top of pits in which cages work landing gears are used; these are four legs, or clutches, fixed to shafts and levers, so balanced as to hang a little over the pit mouth, just below the landing plates; when the cage comes up it sends them back, but directly it is passed they assume their former position, and the cage is lowered upon them, there remaining at rest while the operation of loading and unloading takes place. When this is done the cage is eased up by the engine, the banksman, by means of a lever, moves back the clutches, and the cage descends. The top of the pit is surrounded by a square fence, which is lifted up by the cage, and replaced at its descent; so that for anyone to fall down the pit would almost be impossible. There are various means for keeping the tubs on the cages, some to work by hand and others by foot, but most of the means employed are defective, in that they are not self-acting; in these cases the banksmen often neglect to fix them properly, and the result is the tubs run off, and there is an accident. The best apparatus I have seen for this purpose is a very simple one, and consists of two wrought-iron catches, similar to those which hold open large gates when they are thrown back, hook-shaped, pointing upwards, and fixed to the centre of the bottom of the cage. Under their centre is fixed an India rubber spring. When the tub is run on the cage its first axle passes over the first hook, and is stopped by the second; by this time the second axle has passed the first hook, which rises, and so each axle of the tub is within the hooks, which prevent the tub from running off either way, until the loader, at either the top or bottom of the pit, places his foot upon the outside of one of the hooks, or catches, to release it.

The many patent apparatus in use for preventing accidents in case of overwinding, or the rope breaking, it would be useless for me to attempt to describe; I will, however, notice a few of the best. I have seen one worked by spiral springs, held in tension by small chains attached to the lifting chains: on the rope breaking the springs were released, and these by means of small levers send teeth clutches into the wood conductors. This apparatus worked very well when new, but after it had been in use some time the springs got so weak, through exposure to dust and damp, that you could work them with your hand, and they were quite useless. With this apparatus was used a safety-link, to prevent overwinding: it consisted of two plates, bolted together, with a space between them; they were in the shape of a triangle, and fastened to the pit rope at the top. In the space between the two plates was another loose plate, hinged on a pin. In the bottom of the triangle was a slot hole, in the shape of the letter P; in the loop of the P the dee-link at the top of the cage chain was placed, and the loose plate brought against it, holding it in its place securely. A copper pin went through the loose and triangular plates, to keep the loose one from shaking out of its place. When fixed the loose plate projected beyond the sides of the triangle. At the top of the pit frame was fixed a plate, having in it a round hole, through which the rope worked. In case of overwinding, the safety-link had to pass through the hole, and in doing so the loose plate was pushed in, and cut the copper pin, removing the dee-link out of the loop of the P, and letting it down the stalk, releasing the cage, and allowing the rope and safety-link attached to fly over the pulley. The only objection to this is that the link is heavy, and might do great damage by flying loose so suddenly.

Bellhouse's safety-cages and link, manufactured by Hamilton, Woods, and Co., of Salford, are very good in their way. The link is very simple. One description of cage has weighted levers, terminated near the conductors by wedge-shaped grippers, or clutches, while at the other ends the chain is attached. When the rope breaks the weights are released, send the clutches against the conductors, and hold the cage. The other description of safety-cage is worked by springs, and is, I think, preferable to the weighted one, as it is quicker in its action, if the springs are in good order. I have not yet seen a safety-cage that really fulfils all requirements: they should have strong springs, that are instantaneous in their action, for should the cage get the least headway all safety apparatus are useless; the springs should also be made in such a substantial way as not to be harmed by dust or wet.

Sterne's patent pneumatic rubber spring is a very useful appliance, as used in several collieries to form a platform for the cages to land upon when they reach the bottom of the shaft, thus saving a deal of wear and tear of material. The arrangement consists of four springs, placed in pairs, joined together by wooden beams: the whole forms a soft and elastic cushion for the cage to rest upon. In some instances it is preferred to place the springs on the cage bottom. The springs are similar to those used on railways, and are made of India rubber rings and steel plates, chemically united in the process of vulcanisation.

I had nearly forgotten to describe about the best apparatus in use for the prevention of overwinding. It is the safety-link patented by Mr. Ormerod, and manufactured by Messrs. Greenhalgh and Co., of Chowbent. The link is somewhat similar in construction to the one I first described, but much more complete, and has two great advantages. The first is that the dee-link on the end of the rope is released, and goes over the pulley, leaving the heavy safety-link fixed, which in the other case goes with it. The second advantage is, that on its coming to the bevil hole in the plate fixed to the pit frame, the top of the link which opens and releases the rope, also spreads and catches on the top of the hole, holding the cage fast. This apparatus is, of course, only intended for cases of overwinding, and is of no use should the rope break while the cage is in the shaft.

Dudley, May 23. — Colliery Engineer.

HOT-BLAST STOVES FOR BLAST FURNACES.

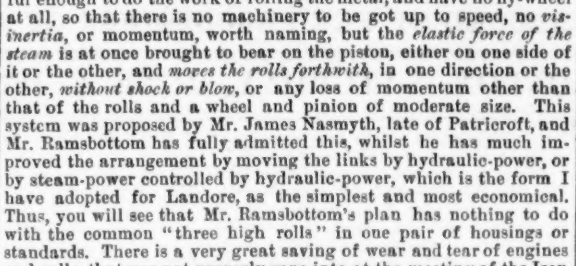
Sir,—The system of rail-rolling or plate-rolling recommended and put in practice by Mr. Ramsbottom, at Crewe, and by Mr. C. W. Siemens, at the Landore Steel Works, from my drawings, consists in having the rolls—*i.e.*, a pair of roughing and a pair of finishing rolls—driven by a pair of engines with their cranks at right angles, and provided with a link motion, precisely like a locomotive engine, so that they will stop, and start, and run in either direction with the greatest facility, simply by moving the link. The engines are powerful enough to do the work of rolling the metal, and have no fly-wheel at all, so that there is no machinery to be got up to speed, no *vis-inertia*, or momentum, worth naming, but the *elastic force of the steam* is at once brought to bear on the piston, either on one side of it or the other, and *moves the rolls forthwith*, in one direction or the other, *without shock or blow*, or any loss of momentum other than that of the rolls and a wheel and pinion of moderate size. This system was proposed by Mr. James Nasmyth, late of Patricroft, and Mr. Ramsbottom has fully admitted this, whilst he has much improved the arrangement by moving the links by hydraulic-power, or by steam-power controlled by hydraulic-power, which is the form I have adopted for Landore, as the simplest and most economical. Thus, you will see that Mr. Ramsbottom's plan has nothing to do with the common "three high rolls" in one pair of housings or standards. There is a very great saving of wear and tear of engines and rolls, that was not properly gone into at the meeting of the Iron and Steel Institute for want of time, and this arises from the fact that the engines and rolls need not be running (as is the case with an ordinary heavy fly-wheel in common mills) except when wanted, thus saving a large amount of steam also. There is less for the men to do when the metal is through on this plan than on any other, and the rolls and engine reverse *quite as quickly*, without shock of any kind, as the men can move the metal from one groove to the next, as in rail or bar rolling, or as they can screw down the rolls in plate-rolling. I have taken the liberty of putting this matter right, as I am fully convinced that it is the correct system of rolling, and will be much used before long—and, therefore, cannot be discussed too fully or too soon. The Landore rail train is a 24-in., but a 30-in. plate train will soon be on at other works. E. A. Cowper.

Great George-street, Westminster, May 31.

CONSUMPTION OF COKE PER TON OF IRON MADE WITH BLAST HEATED TO VARIOUS DEGREES.

The same blast-furnace, ironstone, coke, and limestone used throughout. The ironstone containing 40 per cent. iron in the calcined state.

* * * * * show results obtained by continued working.



THE AERO STEAM-ENGINE.

Sir,—Mr. Bell Galloway is circulating extracts from the *Mining Journal* in which the names of Mr. Warsop and myself are introduced. His assertion "that the aëro steam-engine was his invention" is untrue; and, lest silence should be misconstrued, I request the insertion, in next week's Journal, of this contradiction, based on ample documentary evidence in my possession. If your subscribers wish for a little amusing reading, let them purchase his specification of 1865, on which he says "he had paid the 50*l.* fee," and also the two void specifications therein quoted, on which he has not paid the fee. These documents will be found to be veritable curiosities of patent literature.—*June 1.* — Richard Eaton.

DYNAMITE.

Sir,—Your correspondents, "Edalk" and "C.," while they confirm the opinion of all those who are acquainted with Nobel's Dynamite, that it is the safest, while it is one of the strongest explosives known, refer to the fumes which it gives off on explosion as an objection to its use in underground workings. It is quite true that it does give off a certain amount of nitrous gas, which creates a prejudice on its first being tried in badly ventilated mines, especially if it be not properly managed. But it is an unquestionable fact, from the published statistics and reports of managers of mines on the Continent, where it has been used in substitution for, and to the exclusion of, Gunpowder, that the health of the men is much better than it was when they used Gunpowder. It is also a fact that by a little perseverance the annoyance is overcome, and on the men becoming accustomed to the use of Dynamite they find less annoyance from it, and prefer it to Gunpowder. Much depends on the mode of firing. An overcharge gives out an extra quantity of gas; a charge suited to the work it has to do gives very little. It is desirable to wait a short time after an explosion to allow the particles of dust occasioned thereby to settle, rather than to inhale it.

Your correspondent "C." refers to the facts mentioned in my previous letter as being so damnatory, that he appears almost to doubt the possibility of their correctness. I should not have ventured so to write without having full proof of my assertions. I was in the House of Commons when the extracts from Mr. Abel's letter were read, and I have a copy of it in my possession. I have also copies of the specifications of his several Gun-Cotton patents, and of his reports in its favour, published by Parliament.

A strong Government has its advantages, but it has also its disadvantages, and one of the latter is that any minister of the Crown may, at the present time, pass almost any measure of his own mere motion, though it may prejudice trade, and ruin hundreds. No doubt the Home Secretary was imposed upon, and believed that Dynamite, or any compound containing the slightest percentage of Nitro-Glycerine, was so dangerous that its use ought to be prohibited, and he acted on this belief. He has since received such information on the subject that he can no longer be ignorant of the safety of Dynamite, but he is placed in a difficult and false position by the Act, which imposes on him the responsibilities of granting licenses. I believe him to be so well satisfied of the harmless character of Dynamite, as compared with Gunpowder and Gun-Cotton, that he at one time contemplated granting a general licence for its use, carriage, and storage by anyone. He finds, however, that Parliament (though at his own and Mr. Abel's suggestion) has in effect declared that Dynamite is most dangerous, and the responsibility of acting is greater than he choses to encounter.

When the Nitro-Glycerine Act was in Committee it was proposed by an independent member that Dynamite should not be included within the provisions relating to Nitro-Glycerine without enquiry, but that the Home Secretary should have power to declare, by notice in the *Gazette*, that it, or any other explosive which after enquiry should, in his opinion, be dangerous, should be included within the provisions of the Act. To this amendment the Home Secretary would not consent; he might have been asked to adjudicate on Gun-Cotton as well as Dynamite. Mr. Abel's letter was referred to, and as the Home Secretary would not consent, the Government majority would not listen to the proposition, and hence the difficulty in which he and other parties are placed.

A strong illustration of the wisdom which dictated the proposed amendment occurred within two months of the passing of the Act. A dealer in an explosive compound of a really dangerous character, though it did not contain any Nitro-Glycerine whatever, had a quantity of it in his portmanteau, at a large hotel carried on by a joint-stock company in Wales, and which was full of visitors. During the night the explosive compound ignited from spontaneous combustion. Fortunately the owner was awake at the time, or the place might have been burnt down, with or without a fearful loss of life. The rejected amendment would have enabled the Home Secretary to include this explosive compound within the provisions of the Nitro-Glycerine Act. As it is, the storage, carriage, and use of this and similar compounds are not restricted by any Act whatever. Is it too much to ask that the subject of explosives may be investigated before a competent public tribunal, and the present one-sided and mischievous legislation be put an end to?—*June 1.* — W. O.

PRACTICAL MINING—ORE DRESSING.

Sir,—Some months since I promised to send you particulars of our machinery, and methods adopted for dressing copper ores (equally suitable for lead ores, and I have no doubt with a little alteration to the jigging part a great saving may be effected in dressing the rough tin ores as they flow from the stamps). I thought at that time we should have got all our contemplated improvements at work before now, but from the depressed state of the copper market they are not yet wholly completed. I now send you, however, a description of the inventions in use (and to be put up) at this mine (invented and fixed by myself). I may also name that parts of our lode are wide and dredgy, spots and strings of ore throughout, averaging about 1 ton of copper to 40 tons of lode-stuff, consequently we have to work over large quantities, and I have given the matter of simplicity, economy, and efficiency in dressing careful consideration, and succeeded in accomplishing a saving of full 30 per cent. in labour, scarcely any ore being now thrown to the rubbish heap in the tailings, compared with the skimpings by the old method. All the lode-stuff, as drawn from the mine, is shot into wagons, trammed to the dressing-floors, and emptied on to a perforated plate; a fall of water, equally distributed, then thoroughly washes it, and all the smalls fall through into an inclined launder, and are carried by the water into the self-acting jigging-machines, which effectually separate the metalliferous from the worthless portions. The large poor stones are picked out by a boy, and trammed to the rubbish heaps. All the orey stones that are too large for the crushers are thrown into a Blake's stone-breaker, and thus broken fall on to the perforated plate, the smalls all falling through the meshes are carried by the water to the jiggers, and all the copper stone left on the perforated plate being now reduced to a size suitable for the crushers, are at once thrown or pulled with the rake on to a revolving picking-table, 12 ft. long (or can be made any other length if circumstances require it) and 3 feet wide, working round pulleys, and travelling about 4 feet per minute (the speed can also be regulated as needed), and in its transit all the visible copper is picked out by boys on each side, and thrown behind them into a semi-trough, worked similarly to the picking-table (and driven at a suitable speed), and carried to the crushers; all the poor stone falls over the end of the table into a tram-wagon, and is sent to the rubbish heaps. The crushed work falls through the circular sieve under the crushing-rolls into a launder, and is carried by water on to the sieves in the jigging-hutches (each hutch being about 5 ft. long and 4 feet wide, divided across to receive two loosely-fitting pistons or plungers), and the light portions are carried by the water and the action of the plungers (making from 120 to 200 strokes per minute, as required, the length of the sieve 5 ft.), and falls into another hutch with the same length of sieve, worked similarly; the poor stuff from this falls into a tram-wagon, and is removed to rubbish heaps (it could be worked over other jiggers, if required, before falling into the tram-wagon, but two hutches we have found sufficient). The best portion of the ore, as it enters the hutch from the crushers, by the action of the water and its specific gravity, continues to fall, till it gets down on the sieve; all the small copper falls through into the hutch, but all that is too large to fall through is discharged through pipes into small hutches outside. These pipes are fixed through the sieve, around which a cylinder revolves, which occasions a continuous discharge of clean copper from the first pipe; this, and all the copper in the first hutch, which is run out through a door in the side near the bottom into a large hutch outside, to be removed from thence to pile, to send to market. These jiggers, being wholly self-acting, one boy only is required to attend to them, and to tram the skimpings, or poor stuff, to rubbish heap. The smalls of lode-stuff as drawn from the mine are jigged at the same time and manner, only a longer stroke of plunger and coarser sieves being used.

I could give a more detailed description, but I believe that the machines should be seen at work to be fully appreciated. J. Pope.

New Bampfylde Mines, North Molton.

THE METALLIC MINERAL RESOURCES AND PRECIOUS STONES OF RUSSIA.

Sir,—It is not generally known in England that the Russian empire is immensely prolific in metallic and other mineral resources; yet there are few, if any, substances known under these heads which are not found in some parts of the Czar's wide-spread dominions, which have been estimated by some as equal in extent to the great satellite which attends and cheers our world. It is not more than a century and a quarter since the Russian Government became aware of the presence of gold in the Oural and Oural Mountains, the only part of the empire then supposed to contain that precious metal. However, in less than half a century after, the people obtained in the washings in that district not only gold, but silver, copper, and some precious stones, particularly topaz; subsequently, rubies and carbuncles, so often discovered in the presence of gold, were obtained there.

The methods used to procure the gold from either the sands or the quartz were exceedingly rude, and the quantity, at first small, gradually increased up to 1820, when, with the yield of silver, the value was estimated at 20 millions of silver rubles (2,500,000 sterling). Since then the increase has gone on more rapidly, new fields have been opened up, and now gold-bearing strata are found to stretch along the whole range of the Oural Mountains, from latitude 45° to 67°, in the northern slopes of the Altai, in the southern shoots of the same mountains, on the land near Irkoutsk, along the River Amoor, and in the Kirghis steppes.

In the Oural the gold gravel, or debritus, is not usually more than a fathom from the surface, and is often found 10 feet thick. The gravel is covered with clay, above which is a soft peat, itself covered by the common soil.

The washings on the Amoor are seldom rich, and very large nuggets are uncommon anywhere, even in the Oural or the Kirghis steppes. It is reported that there are very extensive and rich sands in Mongolia, on the other side of the Russian territory, which the Imperial Government is anxious to possess. In Eastern Siberia the washings can only be pursued from May to September. Judges have not hesitated to proclaim that, on the whole, Russia is richer than Australia in gold. Silver is principally obtainable on the Altai, where an average of 60,000 lbs. annually is produced. It is not generally accompanied by lead there. Lead is, however, found in the Altai, and in nearly all the gold mining districts, but its discovery and working are not pursued with either spirit or intelligence, and the total yield is small. No doubt exists of large stores in all those ranges. Platinum is more eagerly sought, as the Government until lately used it in coin; for nearly half a century it has been obtained in moderate quantities in Nijni Tagil. During the last decade there has been less enquiry for it. Black lead, equal to that of the English mines, is found in large

quantities in the Saian Mountains. The Oural Mountains, so productive of the most precious metal, produces nearly all the metals in quantities more or less considerable. Copper was worked time immemorial in several parts of Siberia, and in the Kirghis steppes, but nothing remains of those workings but a well-sustained tradition. Modern operations in quest of copper are little more than half a century old. The mines of Nijni Tagil and neighbouring setts have acquired a great reputation. Nearly the whole eastern slope of the Oural abounds with this metal. It appears, however, that the yield of the percentage of both in ancient and modern times was very small throughout the extensive range in which the ore was found. The manufacture of copper in all parts of the empire where works exist is rapidly declining, in consequence of the fall in price of the metal and the large supplies from South America, and the inadequate supplies of wood for charcoal, the fuel employed in most of the districts where the metal is found.

The declension of iron manufacture in Russia is also obvious, chiefly from deficiency of fuel, and the great distance of the mines from the centres of commerce and civilisation. The iron industry in Russia owed its origin to Peter the Great, and 150 years ago vast mines were wrought and great works erected. The empire seems to produce every description of ore, and each in great variety.

In the Altai and the Oural vast masses of magnetic ore are found. There are various other directions where magnetic ore is found in smaller deposits. Very fine ore for the purpose of steel manufacture is extracted in several districts. Ordinary ores are much more abundant, and are discovered over a wider area of country. In the centre of Russia red oxide is the prevailing yield. One great advantage is that a deep iron mine is not known in Russia; whenever the metal is found it is near the surface. It would be impossible to estimate the resource of the country in iron; probably it exceeds that of any other country in the world.

Chrome and sulphur are also obtained there. Sulphur pyrites abound from the Northern Oural to Pensa. Tin, so much prized in England, has been found in several of "the Goverments" of the empire, but is worked in none. Diamonds have been sought with much persistence, but no mines exist. In the North Oural they are not unfrequently picked up. A single emerald vein was discovered some years ago, yielding some of the finest specimens in the world, but through Government mismanagement and greed it has been lost sight of. The supply of jasper is exceedingly fine and abundant, literally mountains of it may be said to exist. The subject of the non-metallic mineral resources of Russia shall on some future occasion engage our attention, as also highly important and interesting.

SCLAVE.

BRITISH AND FOREIGN MINE REPORTS.

SIR,—The question of Mine Reports is one of public interest, and far more important than generally considered, and as many speculate simply on the chance the results are frequently unfortunate, and it is, therefore, as well to indicate some rules by which to be guided, and what constitutes a good report. Mines and miners suffer so much from ill-chosen mines and crooked reports that I think I can say something useful and practical on the subject.

English Reports.—Let us take a case in point, the much-discussed Virtuous Lady, on which there are two reports which will serve very aptly to illustrate the question, and as I am not connected with or know any of the parties interested I can write more impartially. Capt. Thos. Neill's report is evidently conspicuous for the absence of genuine information, as I will clearly show, and its tone is antagonistic. He commences with what is "called" Metherill's end on what is "called" a lode. This shows what I call the tone of the report, and as for the conspicuous absence of information it is clearly seen on examining Mr. G. M. Henty's report. To commence with, the latter clearly shows he understands that a mine report requires a "full examination at surface and under," and he "carefully reviews the mine on two successive days." Of course a good miner knows that he has a problem to solve, for each mine is a separate study, and the report goes on to show how he fulfilled his object. He saw first the plans, which form the key to the study and solution of the problem, and was guided and assisted by them in forming an opinion. Captain Neill neither saw nor studied them. Mr. Henty then gives the geological formation, showing the importance he attaches to it, and draws the inference, or from experience considers such a formation geologically good for the production of minerals. Capt. Neill considers it unimportant, or of no consequence, as he says nothing on the point, or of the great facility and economy for the development of the mine by abundant water-power from the rivers Tavy and Walkam running by, as well as the facility of crushing minerals there—in fact, that steam-power is not required, which is a most important item generally in the expenses. Henty's report tells us next the number of veins in the sett, and their run, which makes them form a junction towards the eastern part of the sett, which is a most favourable feature to note in the report, and that it is desirable to reach the said point. We are next informed of the width of the veins and their underlies, and that the operations are at present on the north, south, and middle lodes, and that the engine being in the centre will command the general working of the property. From these points a person can judge, and that if there are lodes from 20 to 40 ft. wide that they are master veins, the narrower ones serving as feeders at the junctions, and producing, probably, richer metal there. The prices paid to tributers indicate the quality of the metal being worked till sales takeplace, and we are told the exact percentage of copper. It is not likely people would work unless they got wages, and Cornish miners are generally quite as canny as any Scotchman in their work. Mr. Henty also describes clearly on which lodes the different works are being carried on, and, finally, he winds up with a reference to the classes of ore met with or contained in the lodes. The report, in fact, is so clear that one can almost draw a plan from the description, which is a good test, and it gives information on which a judgment can be formed. We do not want a report to tell us the reporter was pleased, and that his opinion decides the question. We require all possible data on which the reporter founds an opinion, as we may judge differently on the same facts. According to Mr. Henty's report, the north lode underlies south fast, whilst the middle lode underlies north. This is an important feature, from which nothing particular is deduced in the report, which will cause a horizontal junction of lodes, and probably a quantity of ore found at a comparatively shallow depth, in proportion to the underlie and distance of the lodes at surface from each other. Capt. Francis has favoured us with notices on junctions at surface, but not as yet on the junctions caused by the "contrary underlie of parallel lodes," which are not discovered by surface works. There are evidently two classes of junctions at the Virtuous Lady, the first caused by the run of the veins meeting towards the eastern boundary, which may be termed a perpendicular junction, and the second by the contrary underlie of the north and middle lodes, which may be termed the horizontal junction, and will extend the length of the sett, declining towards the west in depth. In the St. Ynes Mine, of the Real del Monte Company, we have an exactly similar instance of veins running towards one point, as regards their run, but one with contrary underlie, the result of which has been a very constant and abundant metal-producing mine, the weekly extraction being 2000 cargas, of an average of 8 ozs., giving 16,000 ozs. of silver. Finally, Mr. Henty's report contains all the information obtainable, and yet it is concise and clear, and does not "crack up" the mine, and should be considered a model report.

Foreign Reports.—A reader asked in the Journal why the stratum was not mentioned in some report of an English mine. This is just what I asked some two years since, in reference to the Almada Company, and also that blue, green, or yellow did not indicate either the quality or class of a metal in a proper manner. These points have been rectified in the Almada and Tirito prospectus. I claim bringing forward these points, especially regarding the necessity of information respecting the stratum, and in the Journal of Jan. 22 say certain rocks produce certain minerals, and that the contents of lodes are in exact relation to the surrounding country or rock. The Almada and Tirito Company appear to have a fine large lode, capable of producing large quantities of poor ores, which in this country constitute the great "bonanzas." Mr. Clunes saw nothing superior to it even in Real del Monte. Our St. Ynes Mine, already mentioned, is alone producing 2000 cargas of 3 quintals each—more than 270 tons per week, the quality of which is as good as the Tirito; and Guatmiocsin is beginning to exceed that extraction, and is turning out to be another Rosario. The Real del Monte own a hundred times as much ground as the Almada, which is by no means a large sett for Mexico, and then the price (100,000*l.*) is no joke, especially when you are to have only 12-24ths of the mines. The Real del Monte terms are 16-24ths for the mines they take up, and no cash payments of any importance. There is this difference, that the mines are given over to be explored, and not with a large lode of ore in sight, as at the Tirito. I sincerely wish to see a dividend-paying mine in this country worked by English capital, and trust that the Almada will have that honour.

Mr. Spargo and others run down foreign mines to exalt British, which is a very mistaken idea. Do they grudge our earning a good living abroad, instead of remaining to starve and eat each other up, as is the case with the present English workman? Mr. Barnard talks of mines in the steppes of the Cordilleras, and others of "torrid zones," and such like bosh. I will give these gentlemen some nuts to crack at leisure. "In Spanish America any man for a few dollars becomes the owner of any minerals he may find, either on public or private land." Two years since 178 Englishmen had to their credit in the savings' bank of their "Mexican" employers, the Real del Monte Company, the sum of $355,000. The London Bank of Mexico being established in the capital, there was no necessity for the Real del Monte to continue with a savings' bank. If mining brokers wish to secure more capital for investment in their especial branch, let them agitate for a reduction of the Crown dues on minerals, and that such dues shall henceforth consist of a percentage on profits, and not on the value of the minerals extracted. Then, probably, you will force the lords' dues to come down to the same level, although it is a hard fight in England against vested interests. It will require a Bill in Parliament to secure a fixed percentage on profits, and the public will no longer have to make terms with the Crown agents. Mr. S. Trevethan, jun. (in the Supplement to the *Mining Journal* of February 5) lays it down clearly—"If the agents of the Crown would condescend to be more liberal in their dues, we should find that thousands of acres would be applied for; and mines, miners' houses, corn-fields, and gardens would spring up and flourish where now scarcely a face can be seen." Now, Mr. Spargo, here is your chance; start a "Crown Mineral Dues Reform League" at once, and give employment to thousands, who otherwise must emigrate to torrid zones, and prefer them, perhaps, to smoky, foggy, consumptive England, after a trial. Comparing the prospectus of the Almada with the Cuiaba Gold Company, the latter is surely half as cheap, only that the latter being near the equator, Mr. Spargo may have to head a subscription list for supplying punkahs for the poor workmen.

The Nevada Properties Trust, and the companies brought out by Mr. Batters, are evidently receiving the public support, because they are good speculations, notwithstanding the anti-foreign miners. The Lucy Phillips seems an incomprehensible muddle; and of Chontales it is reported here that thousands of pounds worth of ponderous machinery lay scattered about the shores of the Lake of Nicaragua, too heavy to be carried to the mines. In this respect British mines have an advantage that nearly all investors of large sums can visit the mines personally at little expense and trouble; but still they find at times that the accounts are topsy-turvy, to the great dismay of the adventurers. It is absurd, however, to grudge money for a good mining speculation because it is in foreign parts. What may be grudged with reason are the loans of millions sterling to foreign despots and Governments to go to war with each other, and sometimes even against ourselves: to nations that have no vote in the matter of their expenditure, and who meet continual deficits with continual loans, and whose extravagance is, consequently, abetted by us. To Spain, who did not pay even the interest of former loans, more millions are given, and then people wonder at a commercial crisis every seven or ten years. Or we have meetings of enraged shareholders or bondholders, demanding Government intervention in their favour, perhaps blockading the coast of some unfortunate country like Mexico, to whom money was lent, in the expectation of making 50 per cent. Luckily, non-intervention will be the future British policy, and people who lend money to the Pasha of Egypt or the King of Timbuctoo should think well of it. India and the colonies can employ millions in railways, telegraphs, banks, cotton, coffee, and in mining; and if foreign countries want money for like purposes, we benefit our own trade and commerce by lending them. We should not then find the Stock Exchange in a panic every time the Emperor of France has the rheumatics, or the Pope a pain in his big toe, or because it is telegraphed that the Autocrat of all Russia frowned on January 1.—*Real del Monte, April* 21. JOHN P. SEWELL.

DISCOVERY OF COAL IN COLORADO.

SIR,—There has been a great discovery of coal near Denver, Colorado, and if it should prove on examination only about one-half what is represented it will be an important discovery indeed, for the Pacific Railway can then be supplied with coal in a central point of its course instead of taking it from its extreme ends. Two specimens sent me I have recently been analising, and find they will do very well for the generating of steam, but are too light for iron furnaces; it is a lignite of first-class quality, very brilliant, burns with a strong flame, has the odour of bitumen, gives out great heat, very little sulphur, does not coke well—that is to say, the coagulation is slight. The samples I had were small, so I could not duplicate the tests; the two I tried gave as follows:—

Water	9·50
Volatile and bituminous	39·65
Carbon	42·70
Ash	8·15=100·00

The carbon was very spongy, and absorbed nearly 8 per cent. of moisture from the atmosphere within 48 hours after exposure.

I leave for Colorado this week, and shall send you some notes. While there I shall have a look at the "Terrible," as I have to make an examination of some other mines in that neighbourhood. A fine cinnabar vein has been found in the mountains of that district, but the Indians are troublesome near where it is situate; the specimens shown me are equal to the New Almaden ores. R. N.

New York, May 10.

COAL MINING IN THE WESTERN STATES OF AMERICA.

SIR,—There has been a good deal of information given lately, through the medium of your valuable Journal, in regard to the development of the mineral resources of Colorado and neighbouring States; but an item of what I consider to be of quite as much importance, and one, too, that in my humble opinion gives more certain and quicker returns for the capital expended has not been mentioned, and that is the working of the coal deposits in these Western States. Here there is very little timber; in fact, not enough for building and fencing, let alone for fuel; and these prairie States are being very quickly settled up, and fuel for railroad and other purposes is fast becoming a very important consideration, as even now, in many places, it has to be transported hundreds of miles to supply the demand. For my part, I believe that there is not a more certain and permanent paying mining branch that can be entered into than coal mining here, when properly carried out. I have been engaged in this business now for some time here, and the longer I stay and see things as they are the more I become convinced that a little capital judiciously expended will yield for certain great profits. I have worked coal here that has paid to the property owners (at the usual royalty rate here) just double the mine rent which I know a few years ago was paid at several collieries in North Staffordshire; and the proprietors of one of the collieries here, of which I was managing partner (consequently, I can speak from experience), reaped a return of over 100 per cent. profit on the capital expended, and paid this heavy royalty in the bargain; and this I know is not an isolated case, far from it. If a company of three to six joined together, and raised a capital of (say) 2000*l.* to 8000*l.*, as required, and prospected by boring, &c., in different parts of these States, at a cheap rate for the coal, then, when certain of the thickness of the vein, bought up one or more square miles of land, which may here be obtained cheap (outside of city limits), and have 10 years time to pay for it in, which is a great advantage, not to be obtained in England, I am certain no more sure paying investment can be entered into, as then there is no royalty dues to pay, and the extent of land bought will warrant a sufficient outlay for proper machinery being erected; so that the coal could be put on the trucks at a low rate, and of the best quality.

Up to the present time none but the surface veins of coal have been worked out west. I was out (about 650 miles south and west) from here a few weeks ago, and the railroad company there offered, if I could find a vein of coal that I could work, to put in a side track free, any distance up to twelve miles, and to take all the coal that could be gotten out. This will show, as much as anything, the importance of this branch of business to this wide prairie country, where one can travel scores of miles without seeing a single tree. Fuel must be obtained, and if it cannot be got at the place it has to be shipped. Coal mining here is not the same as in England; nothing near the expense is incurred. The Americans think a shaft 100 ft. deep to be a great thing. Very little is generally known of the geological stratification in the prairie countries, as there are no upheavals of any magnitude nearer than the Rocky Mountain chain, and they seldom bore more than 50 or 60 ft., and that very rarely. I know that if many of my countrymen in England, having a little capital, only knew the chances to embark in here, which would make them a sure return for the money they expended, they would not stay where there is so much competition in every branch of business; of course, back east in this country competition is as bad if not worse than in England, but out west there are plenty of safe openings, if care is only used in looking around for proper ones.—*Des Moines, Iowa, U.S. America.* T. D. HULME.

GREAT VAUCLUSE GOLD MINES, VIRGINIA, U.S.

SIR,—These extensive mines, which for the past two years have been under a course of re-construction, having been mostly destroyed during the war, were brought almost up to a dividend-paying condition, when the September gold panic of New York suddenly caused their suspension. There are three mines in working, all of which are productive; the ores vary from 2 dwts. to 5 ozs. per ton; the average throughout, as proved by the recent returns, is 7½ dwts. per ton, which, when refined, brings $7·50 per ton; the entire working cost, when 30 heads of stamps are kept going, is under $3·50 per ton; thus leaving an excellent margin for profit. At present not over 20 tons of good ore can be produced per day, but with 12 feet more sinking of the engine-shaft, and the 20 fm. level cross-cut driven out, 100 tons per day can readily be obtained. There is steam-power enough provided to run 78 heads of stamps. The ore is found to improve much in quality as it descends. In the 30 fathom level (when reached) it is anticipated the yield will average fully ½ oz. per ton, all the indications being favourable to such a result; it is the largest and most productive mine in Virginia, but will never be worked to advantage, except by an English company. Quite a little excitement was produced about a fortnight ago by the arrival of Captain Joseph Richards, of Devon Great Consols, who had gone to Virginia, to make a close inspection of the property; he was accompanied by another gentleman from England. The works were set in motion, the mine forked, ore raised, stamped, and various samples tested, the result of which exceeded the manager's report of the produce of the ores. It being the desire of the owners that the mine should give its own report, every facility was offered for a rigid investigation; and as Capt. Richards spent nearly a week on the mine, the inference is he must have found something worthy of his attention or he would not have devoted so much of his valuable time thereon. It is to be hoped his views will be given to the public, for it is mineral properties of this class, where the working capital required is small, and the returns certain, that should more engage the attention of those who invest in foreign mines.—*New York, May* 10. R. N.

NOVA SCOTIA GOLD FIELDS.

SIR,—As the official monthly returns will be forwarded you by the Deputy Commissioner, to save repetition of figures the present letter will give what has not been published before—the statistics of several prominent mines in the province, partly with a view of showing that general statements are more favourable than partial notices, and partly to affirm that the same results would in other countries long since have earned the confidence of capitalists. The districts are taken in routine order.

WAVERLEY.—This district can boast of having produced the greatest annual yield from a single mine—the Bürkner, which in 1865 produced in round numbers 9000 ozs. The Boston and Nova Scotia's and other returns mislaid.

SHERBROOKE.—The Wellington, in four years and eight months, has crushed 9896¾ tons of quartz, and yielded 11,994¼ ozs., the annual yield being as follows:—1865 (four months), 267¼ tons, 622¼ ozs.; 1866, 1289 tons, 3005½ ozs.; 1867, 1592½ tons, 2396¾ ozs.; 1868, 2695 tons, 2769 ozs.; 1869, 2961¼ tons, 2337½ ozs.; 1870 (four months), 1091 tons, 862½ ozs. The Palmerston Mine has reduced 7714½ tons, with a yield of 5820¼ ozs. The New York and Sherbrooke Mine has produced about 5000 ozs., but the returns are not available at this moment: 165 tons raised in 1867, from a depth of 45 ft., gave an average of 4 ozs. 4 dwts. of gold.

WINE HARBOUR.—The Provincial Mine yielded 3702 ozs., from 5837½ tons, between June, 1865, and the close of 1869. The Glenelg shaft, on this property, gave 1242½ ozs., from 1124 tons. The Eureka Mine, in 1868 and 1869, gave 187 ozs., from 225 tons. The El Dorado Mine, 146¾ ozs., from 400¾ tons, in 1865; 88¾ ozs., from 319 tons, in 1866-68; and 251 ozs., from 810¼ tons, in 1869: or, in all, 486½ ozs., from 1530 tons.

ISAAC'S HARBOUR.—The Henderson Mine gave 526¼ ozs., from 230 tons, in 1864; 639¼ ozs., from 294 tons, in 1865; 183¼ ozs., from 59 tons, in 1866; and 924½ ozs., from 535¾ tons, in 1867. The Gisborne, from 59¼ tons, has produced 101 ozs. in the past six months.

RENFREW.—The New York and Renfrew Mine has produced 1412 ozs., from 1656½ tons; the Hartford, 806¼ ozs., from 785½ tons; the New Haven, 809¼ ozs., from 1340¼ tons; and the Ophir, 15,617¼ ozs., from 18,733 tons. The annual yield of the latter reads as follows:—1866, 3044¼ tons, 4709 ozs.; 1867, 5371¾ tons, 5953¾ ozs.; 1868, 5045 tons, 2917 ozs.; 1869, 5372 tons, 2037½ ozs.

UNIACKE.—The Uniacke Mine, from June, 1867, to the end of December, 1869, contributed 3340 ozs., from 4310¾ tons; the Montreal Mine, 824 ozs., from 1509¼ tons, in 1868 and 1869.

MONTAGUE.—This district has given an exceptionally high yield since its discovery. The pyrites are highly auriferous, as well as the quartz. The principal mines are the Leckie and the Lawson, but no general data at hand from either.

TANGIER.—The productive mine of this district is the Strawberry Hill; the average per ton has been uniformly high, and the monthly yield for the past three years an average of 100 ozs.

OLDHAM has been divided into very small areas, which have frequently changed hands. Some cross leads have maintained an average of 8 ozs. per ton. The productive mines are the Sterling, Boston and Nova Scotia, Caledonia, Shaffer, and Donaldson.

MUSQUODOBOIT.—This district was only opened in April, 1869, but produced 1001 ozs. in eight months, with a moderate force at work. One lode, in places 22 ft. wide—that is, slate and quartz together—gave 369 ozs., from 1017 tons; another lode, 5 in. wide, 48¼ ozs., from 72 tons; and another, 18 in. wide, 131¼ ozs., from 97 tons. The Hyde lode gave 422½ ozs., from 398 tons; and the Touquoy, a cross lode, about 4 in. in width, 205 ozs., from 75 tons.

The foregoing are the results of a series of crushings, and demonstrate more practically than partial and disinterested references to a single property that the gold mines of Nova Scotia might be made dividend-paying when worked economically on a large scale, and not bought at a price wholly disproportionate to their actual earnings.

Halifax, U.S., May 20. ACADIENSIS.

GOLD MINING IN NOVA SCOTIA.

SIR,—You will be kind enough to insert the following in your valuable Journal, for the guidance of all speculators in the gold mines of Nova Scotia.

1.—The mines of Nova Scotia have been represented to be famous for gold, and that a small capital is all that is necessary to open up the mines and fix machinery to work them, when good results would follow. I have been through the principal gold mines in Nova Scotia, and have found them nothing like as represented—in fact, there is scarcely a mine in the province that is paying expenses.

2.—The gold-bearing veins in the province are from 2 in. to 8 in. wide. The large lodes or veins are not productive—in fact, will not pay to work in any way. The small veins are numerous in different localities, and worked first by the windlass, and then the horse-whim, but often steam-power is erected: they do not pay.

3.—Machinery has been set to work in different parts of the province on the small veins, and the result has been that the companies have spent large sums of money, and scarcely any one of them paid, and if they did it was but for a short time; consequently, the whole capital is expended—mostly, indeed, by men who do not know the practical part of mining.

4.—There is a mining district about thirty miles from Halifax, called Oldham, which has been represented as very valuable to capitalists. Part of the same property was worked by an English company some few years since, when the loss was great—about 40,000*l.*—owing to the small veins and the injudicious mode of working.

5.—There is a mine now working, and for which they are endeavouring to form a company in London to extend the operations Now, with all that could be done, and working the best-paying

uartz, I believe the loss has been from $500 to $600 per month. The water-charge has been very easy—about four barrels per hour in the summer months. The depth of the mine is about 240 ft., the length of mineral ground 140 ft.—average, about 6 in. wide, and barely 1 oz. of gold to the ton of quartz. It will cost $18 per fathom to blast the rock; value at 4l. sterling to the ounce, and cost of blasting 3l. 12s. How, I would ask, is it possible that this mine can pay, cost, when you consider other expenses, such as filling, landing, horses, carriage, crushing, agency, &c.? The cost of crushing alone is 2l. per ton. They are erecting a new crusher on a part of the property which was worked some years since by an English company at a loss of 40,000l. They have commenced to sink the main shaft in one corner. The length of the property is 1050 ft., by 250 ft., and 5 ft. wide. They have, therefore, that distance to drive a tunnel west and north to prove the different lodes.

6.—I proposed to the company to sink the shaft in the centre of the property. By doing so they would be enabled to work three different lodes almost at once, after the shaft had been sunk to any depth that might be determined on, and would prove the property for less than one-half the capital it will cost by the present mode. Such waste of capital in erecting buildings and machinery on the surface I have never seen before in any country, when every economy should be used for the working of such small veins.

7.—In looking over the property of the Stirling Gold Mining Company, and the manner in which they have commenced to spend the money, I would recommend the company in London to send out a practical man whom they could trust to give them a faithful report before they go too far in proving the property in its present state.

8.—I have been engaged as a practical miner upwards of twenty-five years, fifteen years of which time I had the management of two of the largest tin mines in Cornwall. I find that anyone with practical knowledge of mining is of no account; nothing but theoretical engineers will do for the working of mines in this province, with captains who have no experience in mining. They seem to be afraid to let contracts, because they do not know the price of a foot or fathom of ground; consequently, the mines are worked by day's pay. If the mines of Cornwall and Devon were worked on the same principle scarcely any of them would pay.

April 25. A PRACTICAL MINER OF THIRTY YEARS' EXPERIENCE.

MINERAL WEALTH OF COLORADO.

SIR,—Ever since the Paris Universal Exhibition of 1867, at which Colorado ores received the gold medal prize against ores from all other parts of the world, European capitalists have been giving their attention to the Territory for the purpose of verifying themselves the extent of her mines, their character, and the facilities afforded for the profitable employment of capital. The country will bear inspection; consequently the reports and representations of competent persons sent from Europe, and the reports of the Government Commissioners sent by the United States, fully confirmed all that has been said of it.

We find by these reports that the mountains are seamed with mineral in certain directions. A belt of about 20 miles in width runs through the territory in a direction of north-east by south-west, which is so thrown into view by the formation of the mountains, that already quite a number of rich mining districts are located on its line. This belt contains gold, silver, and other minerals, but is as yet only worked for the precious metals. The ores in the different districts differ somewhat in appearance, but are all more or less sulphuret ores, being a class specially adapted for smelting. These mountains seem shaped by nature positively into the most convenient forms for the easy and economical extraction of their riches. They are thrown up into ranges of hills rising 2000 to 4000 feet from their base, and almost invariably bounded on one side by an inexhaustible creek or river, available for power for driving machinery for dressing the ores, or other purposes. From the formation of the mountains, several adits can be driven at the same time, to cut the lodes at varying heights and depths, and the mines thoroughly opened in an inconceivably shorter time than by means of shafts sunk from the surface. By these adits or tunnels the mine drains itself, and the ore is easily and cheaply delivered at their mouths by tramways, from which, by means of a wire aerial railway, they are carried to the foot of the mountain to the dressing works; the heavy and constant expense of fuel, pumping, and hauling machinery being entirely done away with.

Colorado only requires capital, smelting works that will properly and economically treat her ores, and cheaper labour, when she will, as stated by the United States Commissioner of Mineral Lands, in his last report to his Government, "rapidly advance in wealth and power." But with interest at 3 per cent. per month, smelters who charge $50 per ton (2000 lbs.) for smelting, and guarantee merely 80 per cent. of the contents, saving only gold if treated for gold, silver if treated for silver, wasting the copper, lead, zinc, &c., and labour at $3 to $4 per day, she has steadily, year by year, continued to advance in wealth, civilisation, and population, in spite of these drawbacks, a proof positive to the most sceptical of the undoubted richness of her mines, for had they not been as represented, the Territory would have remained a *terra incognita*, as it was little more than 12 years ago. The first discoveries of gold was made in Colorado towards the end of 1858, then the Territory could only be reached by wagons over a road of 700 miles; no stage or mail communication whatever; no settlement within hundreds of miles, no habitations, no roads, nothing but wilderness. Now she is peopled by tens of thousands of inhabitants, in instantaneous communication with the world by telegraph. In daily communication with all parts of the States, and within five days of New York by railroad, her cities are equal to any in the world for their age, and superior to anything we Europeans can imagine to have been built and populated in the short space of 12 years. The resources, then, of a country which has so prospered, under such disadvantages, must be more than ordinary.

Colorado possesses fuel in abundance, forests clothe its mountain sides, and inexhaustible beds of excellent coal lie at their feet, fit for smelting or domestic purposes, which nature has again placed in the most available manner possible for extraction, the coal beds being upturned at the base of the mountains, and by merely tunneling a few hundred feet in, several excellent beds of coal may be reached. Natural deposits of carbonate of soda exist; one remarkable lake, a few miles from Denver, is so strong that it will yield 30 per cent. of the crude carbonate, sufficiently pure for metallurgical uses; numerous salt springs occur in the mountains, and fluor-spar in abundance. These three minerals, in conjunction with coal, seem to have been purposely placed by the allwise Creator in close proximity for the purpose of utilising the vast metalliferous riches. Iron, copper, lead, zinc, and other valuable minerals abound in Colorado, but, from the great profusion of the precious metals, occupy little attention at the present moment.

What is most remarkable is—that all this wealth and prosperity are within eighteen days' travel from England, not in an unhealthy wilderness, inhabited by savages speaking an unintelligible language, but in a land governed by constitutional laws, peopled by our own descendants, speaking our own tongue, and possessing a most salubrious and health-giving climate.

It cannot, then, but be desirable that those seeking new investments, or desirous of emigrating to a more prosperous region than over-crowded Europe, should devote some attention to the mineral, agricultural, and pastoral resources of Colorado.—*British and Colorado Mining Bureau*. WM. COPE.

MINING IN CALIFORNIA.

THE GRASS VALLEY CONSOLIDATED.

SIR,—If it were possible, I would like to stimulate the shareholders in this mine to more active operations. I am satisfied, through recent discoveries and improvements, that they are in possession of a permanent dividend-paying mine, and I am really sorry to see things carried on so tardily. When Colonel W. O'Connor Sidney put me in charge I had a hope ere this our mill would have been erected, and that we should be in a position to crush our rock, so as to save the cost of hauling the rock six miles to a customs-mill, and enable the shareholders to declare an early dividend; but through such slow progress my plans and calculations remain in *statu quo*, and for want of means nothing at present can be altered—a circumstance much to be regretted, the more especially when we look at the cheering prospects we have before us. Some few days since the mine was visited by Capt. Evans and Capt. Seadon, who very much liked the situation of the mine, also the character of the rock we are taking out, and appeared satisfied as to its quality. We shall commence crushing on May 2, computed, 70 tons of rock, supposed to be a very high grade, as it contains a large percentage of visible gold. I sincerely hope that the colonel's exertions will be attended with success, and in a few weeks at least everything connected with this lucrative mine will be seen in full operation.

Grass Valley Consolidated Mine, April 30. T. FAULL, Superintendent.

MINING IN CALIFORNIA.

GREENHORN MINE, GRASS VALLEY.

SIR,—During the past two weeks the above mine has been twice inspected by Capt. Francis Evans, a gentleman I presume well known to the mining capitalists in London. His inspection had something to do with my supposed fabulous reports which recently appeared in the *Mining Journal*. From the fact I could wish it to be distinctly understood that my object in writing to the Journal is not to deceive, but, if possible, to keep the public from being deceived; therefore, you can well imagine my feelings on meeting with Capt. Evans, who will return to England prepared to endorse every word of my reports, also bearing with him specimens testifying as to the richness of this valuable mine. He thinks—and rightly, too—that so far as the mine has been developed it has proved equally as rich as the Eureka, and suggested that the name Greenhorn should be changed, and a name worthy of its merits given to it. Henceforth the mine in question will be known as the Eureka Consols.

Since Captain Evans's arrival in Grass Valley he has been assiduous in his duties, having inspected and examined quite a number of mines, which will on his return to London enable him to render some valuable information, and give a good account of his stewardship. The mines thus examined by Capt. Evans will be noticed in my future letters to your valuable Journal.

Eureka Consols, Grass Valley, April 29. T. FAULL, Superintendent.

THE PEN'ALLT SILVER-LEAD MINE.

SIR,—Mr. Henry Sewell, consulting engineer to the Dylluan Copper Mine, is good enough to promise some account of his visits to mining properties in Wales, but I am at a loss to discover any advantages arising from the information he intends to communicate if it be no better than that contained in his last letter. He refers to the Pen'Allt Silver-Lead Mine as being in what has always been considered as a copper country; and, with a judicious regard to the interests of the mine with which he is associated, he hopes that the discoveries of lead at Pen'Allt will be advantageous to the copper yield at Dylluan, and at the neighbouring copper mine too. This is a sort of damning with faint praise, that shows Mr. Sewell to be but a poor sort of guide, and if his judgment is no sounder with regard to the other properties he visits it will not be worth very much, engineer though he be. The Pen'Allt hill may contain copper, but its principal deposits are argentiferous lead of a high standard of quality. They have been found at no fewer than six different points, though up to date the lode at No. 4 cross-cut had not been struck. Without giving those places the names that appear upon the company's plans, I may say that, commencing near the manager's house, and proceeding eastward, the lode crops up to surface near the turnpike-road, and the opening may be seen by every passer-by. Then there is No. 1, extending the whole length of the sett, fully a mile; 60 fct. higher, or northwards, is No. 2, and on each of these lodes rich openings have been made, from which ore is being extracted to nearly the extreme east of the sett. From the winze below the No. 3 the like class of ore is being won, and at No. 4 cross-cut, where the lode is in hourly expectation of being cut, all the appearances are highly favourable. The lowest estimate of the value of the ore is 15l. per fathom, while from No. 1 the estimate is 30l. per fathom. No veins of copper, or only very partial signs, have yet appeared; and from the experience already acquired it is as certain as anything in mining can be that the space between the two lodes already opened will prove to be a solid vein of the richest argentiferous lead, from 25 to 30 feet in width, and not much less than a mile in length. Besides this, there is the great caunter lode as yet untouched, and a lode, believed to be upwards of 60 feet in width, close to the summit of the hill. These conditions subvert the idea of this being a copper country.

Being at Pen'Allt, it would only have been becoming in the consulting engineer to the neighbouring, but yet unproductive, Dylluan Copper Mine, while professing to narrate the experiences of his visitation, to have referred to what the company have done during the few months they have had possession of the property. I will endeavour, though imperfectly, to supply the omission, and everyone visiting the spot can see for themselves whether I state facts or not. The water-wheel is nearly erected, the stream has been prepared by damming, and launders for turning it, the crusher and rollers are in process of fixing, patent dressers are contracted for, and in three weeks the incline from the adits and openings of the mine to the wheel, which is to convey the ore to the crusher, will be ready. By the end of the current month the practical operations of the mine will be commenced, and lead will be produced in sufficient quantities to enable the directors to pay a dividend for the quarter ending with September—that is to say, in less than nine months from the purchase of the property.

This will decide the question which Mr. Sewell has started upon imperfect acquaintance with the locality, whether Pen'Allt is in a lead-producing mountain. As to the estimation in which it is held in the market, the present price of the shares is an untrustworthy criterion. Certainly those who rely upon it will find themselves mistaken if they take it to indicate the value of the property. All lead mining shares are for the time unduly depressed, but it should be remembered that there is a reaction in all things, and that sound undertakings, such as Pen'Allt, will ultimately justify themselves before the public.

London, June 1. J. B. H.

AGENTS' SALARIES IN WALES.

SIR,—I observe in last week's Journal that Mr. Henry Sewell has again brought to public notice the miserably low salaries which many public companies pay their agents in the Principality. I know that I shall be expressing the mind and feelings of a number of agents here by thanking that gentleman for the kindness he has shown towards us in bringing before the public a question which, to us, is of so much importance.—*Llanidloes, May* 31. JOHN ROBERTS.

MINING IN THE NORTH OF CORNWALL.

SIR,—This portion of the county appears at length to be about to receive the attention which its great mineral wealth demands. The beginnings now made will doubtless result ere long in much profitable enterprise in this district, and it will soon be a matter of wonder why it was so long neglected. Two or three causes especially seem to have led to this neglect. The Cornish miner of half a century ago, in his search for tin, copper, and lead, seems to have regarded nearly all the other ores as of little or no value; and so he often threw aside on his attle heaps ores of more value than either of them. In the case of Old Treburgett, for instance, it has been demonstrated that *silver ores* of great richness were cast away as worthless, and such ores may now be gathered out of the loose stone walls which divide the pitches, and from the old heaps about the mine; and the traditions of the neighbourhood relate that they were even broken up to mend the roads. The Cornish miners appear, too, to have been ignorant in those days of the great value of their lead ore, from the large percentage of silver it contained; and it was sold simply as *lead ore*, for about 8l. per ton—less than one-third of its value, as has lately been shown by actual sale of ores from the very same mines.

Yet, even with these disadvantages, mines in this quarter of Cornwall are known to have paid good dividends down to a certain depth of working. Then, another cause presented itself to the miner for abandoning his enterprise—the large increase of water overpowered the means he had for freeing himself from this obstacle to his operations. He might have freed himself from it, indeed, by the aid of large and powerful engines; but the expense of such engines was great, especially in those days, and the rate at which he sold his ores did not encourage him to incur so great an expense. It thus happened that good mines were abandoned when carried to the comparatively small depths of 50 or 60 fms. only. But why, it may be asked, has the working of them been left so long in abeyance? Doubtless, from the first cause I have named—the great richness of the ores not being known.

But now all this is changed; the large percentage of silver in the lead ore has been demonstrated, both by assay and sale, and the true silver ores have received their due recognition; and, still more, not only has this been shown to be the fact in the case of old mines, but wherever new lodes have been opened the lead ore has been proved to be of similar richness in silver. A new lode, for instance, has just been broken into by a company who, in their greed for gain, have dared to invade the very sanctuary of romance—the rock on which stands the castle of Tintagel, in which the Knights of the Round Table held their high carousals. To propitiate the shades of these, and of the prince of all chivalry, they have wisely adopted the title of "King Arthur" for their name. As to the gain they seek, truly they seem likely to achieve it, for almost at the first stroke of the pick they appear to have laid open a leader of solid silver-lead ore, 6 to 9 inches in thickness. What, then, may they not hope for as they descend in depth? The very gossan of the lode, moreover, seems to be rich in silver, and by actual sale has brought 3l. a ton.

This company I see proposes to carry their workings, not only into the land, but beneath the sea, and to undermine, it may be, the mystic realm of Lyonness itself. Whisper it not to Tennyson, lest the wrath of his muse be kindled, and vent itself in a withering ode on the *argenti sacra fames*.

But to leave the domains of romance and poetry, and to return to the question we started with—the mineral wealth of the North of Cornwall—the cases I have named are but specimens of the general character of the district. The mineralogical formation, generally, is favourable for silver, as well as for silver-lead, and I unhesitatingly predict that before many years are over this part of Cornwall will be attracting more attention, and calling forth more enterprise, than either Wales or Shropshire. CORNUBIÆ AMICUS.

[For remainder of Original Correspondence, see this day's Journal.]

METALLINE—A NEW INVENTION.—A number of scientific and practical gentlemen, connected with manufacturing and other machinery, have been for several months watching the operations in this city of an invention that aims at the entire abolishment of oils and all other lubricating material for boxes, slides, and every condition of motion where metallic friction is to be overcome or expected. It is claimed that such a result has been fully achieved, and there are engines now running with this material, that the proprietors aver have worked to complete satisfaction for weeks and months. Such, in general terms, is the claim of this novel invention. It is the work of a scientific and practical gentleman, well known here and in Europe, who has spent a great many years in the study of physical forces and their effects, with especial reference to metals. The exact nature of the present invention cannot be given, for the reason that patents are being sought for in several countries in Europe, and any clear description of the materials and processes would be likely to defeat that end. It may, however, be said, in a general way, that the discoverer (who has received the name of metalline—consists of such combinations and manipulations of various metallic substances as to make a surface on which the ordinary journals, axles, crank pins slides, &c., of iron, steel, brass, or any other metal, will run with much less friction, without heat that comes within the slightest possibility of danger, and without increase (in fact an actual decrease is claimed) of the motive power used. Those, briefly, are the claims, and the inventor refers to a large number of trustworthy gentlemen who have examined and tried the thing, and speak from actual knowledge. Supposing this invention to do what is claimed for it, the wide extent of its use and its real value to the world may warrant the statement made by an eminent engineer, that its importance is above that of any of the great discoveries of the time. In the silk, cotton, and woollen mills of this country alone, the use of oil subjects manufacturers to large losses on goods spoiled by it, to spontaneous combustion where it is not constantly watched, and to heavy expenses for the cost and application of lubricants. On railroads disastrous accidents have often occurred, and annoying delays have been endured, from hot axles; and wherever wheels revolve we hear shrieks for grease that indicate neglect, superfluous wear, and perhaps immediate danger. Now, if we could run axles of Bessemer steel in boxes of Rockland Lake ice, the dangers, delays, and detentions of friction would be avoided. If this metalline proves to be all that is claimed for it these same losses and dangers may be avoided by its use. We are told that a company has undertaken to put this discovery in practical use in a public way as soon as the proper arrangements can be perfected. How far this invention will fulfil these conditions remains to be made manifest to the public.—*New York Bulletin*.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XLIV.—I have now to bring before you a good deal of apparatus of a mechanical kind, which has to be employed in the shafts of a mine, and according to the depth from which the mineral has to be lifted, and the quantity that has to be raised, the power employed will be the result of animal or manual labour, or of steam. Amongst these certain things come into play largely in particular mines, and to a small extent in others. Thus the windlass is employed to a great extent in metalliferous mines, while in collieries and in working stratified deposits it is scarcely ever to be seen. It is a machine of a very simple character, and dispenses with all sorts of apparatus and the friction produced thereby. To a moderate depth, and with small quantities of material to be operated upon, it is very efficient, and unattended with risk. Why then, it may be asked, are not windlasses employed in working stratified deposits? Because in the latter the apparatus for drawing is necessarily concentrated at one or two points, the weights to be lifted are very considerable, and the speed required necessitates a class of machinery as good and as perfect as can be. The circumstances under which metalliferous deposits are worked are, besides, very different to those which are stratified, not only as to drawing, but in the immense amount of work going on. Up to a certain point they are much alike, but as a vein is opened level after level is driven out, and the workings are spread over a large area, with after all, as compared with a colliery, but a very trifling amount of "get" at each working place. But recurring to earlier operations, as, for instance, in the case of shode pits, which may be put down in two or three places at once, and levels driven from one to the other. After a while one of these pits may become the engine-shaft, and the first working level, we will suppose, is at 60 fathoms. It now becomes of the highest importance that the plans are well devised, and that the engine-shaft should be as central as possible. As the levels are driven and winzes sunk from the one to the other, the material is wound by means of windlasses through the winzes, and so by the levels to the shaft. Working places in a large metallic mine are often from 100 to 200 fms. away from the drawing shaft, and it is often a question whether machinery should not be introduced, or whether a number of winzes should be sunk and worked by windlasses, a condition of things which in the last century used to be extremely common, so much so that in a large proportion of mines winding the mineral and water was the heaviest part of the expense. I have known cases in which half the men were employed in winding, and thus absorbed a considerable amount of what might otherwise have been profit. When this occurs it naturally strikes at the root of the system, which can only be defended while it is employed in what may be called the preliminary work of driving the levels when the one below is worked from the one above, and the material is raised by manual labour from one to the other, and then carried by some cheap mode of conveyance, such as hand wagons, to the shaft, by which it is raised to the surface. When, however, a mine is in regular work, and you see in going along the levels a number of windlasses at work, you may be sure there is something wrong, and that, either knowingly or unknowingly, economic principles are not properly carried out. I do not say that mines worked systematically and judiciously may not have to employ windlasses somewhere, as, for instance, when in driving a lower level a winze is sunk from above for ventilating purposes; but work of this class requires on the part of the men no particular skill, and in most cases the men employed are simply labourers, and not skilled miners. In other cases where the ground is hard, and no great quantity can be broken down in a day, the miners themselves will wheel it to the winze, and raise it themselves.

Before we take a glance at the modes in which the mineral is raised, it will be necessary to say a few words on the ropes and chains used with the wheel and axle, worked by human labour, or horses or mules. Of ropes made of vegetable fibre of some kind, twisted in various ways, those most common have three strands of hemp, saturated with tar to one-sixth or one-tenth of their weight. A great many years ago in the colliery districts it was found advisable, for the sake of convenience, when one turn of the rope laps over the other to employ flat ropes of hemp, which were made by attaching two and sometimes three of the ordinary ropes together. A great advantage was then gained when employed at considerable depths, because when the rope is passed over and over again around itself on a drum the leverage on the pulley differs at different parts of the descent. At the first starting, suppose there be a given weight at the bottom of the rope to be raised, that weight will then have its utmost effect, but as the rope winds up the strain grows less and less, until at last, when the weight has been brought up to the surface, the wheel will have a greater leverage, and the engine also be able to deal with the weight more easily, because the weight of the rope is taken off from the weight of what has to be raised. And so in going down the deeper the weight gets in the shaft the greater the strain becomes; and to make the most of this circumstance it is usual to employ narrow drums with flanges, to prevent the rope slipping off at the sides. There are other vegetable materials besides hemp used for ropes, which are supposed to be cheaper, but which, when taken in connection with durability as well as cost, will probably be found to have no advantage in that respect. Amongst these one of the most useful is the fibre of the aloe, which is not only used in Mexico, where it grows with the greatest luxuriance, but has also been tried in some of the German mines, with no advantage, probably, as to weight, but it is said with a certain amount of economy. Of course, the weight of the rope is a great addition to the weight of the kibble, and many devices have been tried to lighten them, amongst which is that of tapering them. Thus the upper part is made thicker and stronger, because it has to bear the whole strain, while the lower part has only the weight of the kibble and its contents to carry, and in this respect aloe fibre is said to afford some advantage. In the Spanish peninsula esparto grass has lately been much used. At first it goes very much against the grain to get on a rope of this material, and considering the shortness of the fibre it certainly seems rather dangerous, but in districts like the South of Spain and Mexico it is a material which must not be neglected on that account, because its cheapness and the facility with which it can be obtained gives it great advantages. It must be remembered, however, that in these countries there is a great deal of windlass work, and for that purpose grass ropes are much used. About 1830, however, it struck some of the miners of the Hartz, who have to deal with great depths, that these vegetable fibres might advantageously be replaced with iron wire; and after some experiments wire ropes were adopted, and their use quickly spread through the mines of northern Europe. Strange to say they came last into vogue in England, although here hemp is dearer and iron cheaper than on the Continent. It was found on the Continent that, although iron is not particularly cheap, as compared with hemp, nevertheless great economy resulted from the use of ropes made of that material, partly on account of its durability and partly in consequence of its lightness, as compared with hempen rope. The person who introduced iron wire ropes into England was Mr. Lewis Gordon, who entered into partership with Mr. Newall, and laid the foundation of the well-known firm of R. S. Newall and Co., who took out a patent for the invention. The practice of employing wire rope has since become very extended, not only in mining operations, but in the rigging of ships. It has not, however, thoroughly taken root in metalliferous mines, owing to its advantages not being understood, and to the circumstance that its application has not been attended with that care which is requisite to realise the full amount of economy from it. It is obvious that a rope consisting of a few wires must not be brought too rudely into contact with the sides of the shafts, and that it must not be wound too shortly over the pulleys. It is impossible to give wire rope a fair trial if pulleys of only 1, 2, or 3 feet diameter are used, as was frequently the case in metalliferous mines. The diameter of the drum should not be less than 5 or 6 ft., nor should the pulley be of less dimensions. If the shafts are very irregular in form, rollers ought to be employed to keep the rope from rubbing against the sides. Wire ropes are made of different forms and sizes. In some instances they are composed of many small wires, closely twisted together, whilst in some districts, as in Hungary, they are made of few wires of larger diameter, and very slightly twisted. You will readily understand that if wire be twisted as sharply as hemp, it would be very apt to break, and I believe that in many instances wire has been twisted to a greater degree than it is capable of, consistent with safety. Flat ropes have also been made of iron wire, and this variety has had a very extensive run for many years in collieries, and from their first introduction up to the present time it is thought there is no kind of rope equal to them. They are very much lighter than hempen ropes, and have the advantage of overlapping one turn upon another on the drum. Another advantage attending them is that which also applies to the flat hempen rope—that there is a much greater regularity of motion in the shaft, instead of the constant contortion and twisting in the case of round ropes.

Considerable prejudice was felt towards the wire ropes on their first introduction, owing to the reluctance of the men to trust their lives to so slender and apparently so weak a support; but, nevertheless, the good work effected by them soon make them to be valued by the miners. In the case of very deep mines, it would be almost impossible to carry on the workings unless wire ropes were used, in consequence of the very small quantity of material they would be able to raise if any other kind of rope be used, on account of its greater weight. Steel ropes have also been brought into use in this country and Prussia, and so far as they have been experimented with they have given satisfaction, but they have not been adopted on a sufficiently large scale to judge positively of their merits. Steel being of smaller diameter than iron, greater care is necessary in seeing that it does not pass over so small an angle as to snap it, and that it should not come into contact with the rocky sides of the shafts. Chains of various kinds have been largely employed for drawing loads in shafts, more especially in metalliferous mines, and there is at all events this great convenience about chains, that they may be allowed to pass over pulleys of comparatively small diameter, that less damage will result to them by coming in contact with sides of shafts, and that with chains several shafts can be served by one engine. Single-link chains, with whatever care they are used, are very liable to break, and if only one link be of inferior quality, it will be just as disastrous as if the whole chain be of the same character. Besides, it must be remembered that chains, rubbing as they do over a large number of guide pulleys, are subject to that change of structure which has been so often commented on in respect to the axles of railway wheels and other wrought-iron articles, that although the iron may when manufactured be of a tough description, yet after a time it becomes brittle. Another variety of chain, which is extensively in use in the central districts of South

Staffordshire, Worcestershire, and parts of Shropshire, is the three-linked chain, a very strong but at the same time a very ponderous chain, having the appearance of a flat rope. One advantage possessed by this chain is the extreme improbability of the whole of the three links breaking at once, whilst if one broke it falls out of position, and is at once observed. I have heard of one or two cases of chains of that class being wholly fractured, but they are exceedingly rare. The chief objection to their use is their very great weight, being from 10 to 16 or 20 lbs. to the yard, hence it may be readily conceived that when they have to deal with a depth of 200 yards it will be very desirable to introduce some other kind of rope. I need only say a few words as to the ordinary forms in which apparatus is brought to bear when manual labour is used. The windlass seems a simple piece of machinery, but, nevertheless, it varies considerably in construction, and some are more ingeniously made than others. The principle is that of the simplest form of "wheel and axle," with the addition of a drum, which generally forms the barrel of the windlass. The drum or barrel is generally from 6 in. to 1 ft. in diameter. In a few instances, chiefly abroad, it may be considerably more. The average depth to which the windlass is worked in our metalliferous mines is not more than 10 fms., that being the extreme depth; but in Saxony double that depth is often worked by its means. In most cases at starting the windlass is placed over the shaft, but to prevent accidents from the rope breaking it is generally in collieries conducted over a pulley, and worked at the side. In some parts of France and in China it is arranged so as to form a sort of tread-wheel, turned by the weight of the men placed upon it.

SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE INSTITUTE OF MINING ENGINEERS.

The monthly meeting of the South Staffordshire and East Worcestershire Institute of Mining Engineers was held on Wednesday, at the Swan Hotel, Wolverhampton. Mr. North (the President) was in the chair, and he was supported by Mr. Henry Johnson (hon. sec.), and by a strong muster of members. Mr. Joseph Stokes, solicitor, of Dudley, and Mr. Brooke Ridgway Smith, mining engineer, Handsworth, were elected members of the Institute; and three gentlemen, mining engineers, of Newcastle-under-Lime, Burslem, and West Gorton respectively, were proposed. It was made known that in consequence of a contemplated visit of the members of the North of England Institute to Glasgow this summer the return visit by them to this district has been postponed until next year. The arrangements of the proposed Belgian excursion were modified. It is proposed that the members who go out shall leave London on Saturday, the 18th inst., by way of Harwich, for Antwerp, arriving at Antwerp early on Sunday morning; thence to Brussels, Waterloo, and the coal and iron districts of Mons, Charleroi, Namur, and Liége. It is intended to return by way of Paris, staying there on Sunday and Monday, the 26th and 27th, returning by way of Rouen, Dieppe, and Newhaven to London, arriving in the metropolis at about the 28th instant.

Mr. WALTER NESS, of Pelsall, read a paper "On Coal and its Products." The author said that coal might be briefly defined as mineralised organic matter, containing other earthy impurities in greater or less proportion. He then drew an analogy between peat and coal, from which he inferred that coal, like peat, was the result of decomposed organic matter, and argued that whether the formation of our coal fields was by the drifting of the plants of which it is composed into estuaries or lagoons, or whether they were originally peat mosses and forests, which lived and decayed on the spot where we now find their remains, or that both processes had been at work, it was evident that these vegetable growths did take place, and that they had become consolidated carbonished matter. This we now possessed in our different varieties of coal. After describing what must have been the nebulous condition of our planet before the appearance of organic growths germinated on its surface, Mr. Ness gave instances where the inflections and incurvations in the transition strata were subtended by horizontal bases of only one-third of their original length. In rising in the scale of formation, the unconformability of the strata became less. Hence, he argued strongly that this earth must at one time have been much greater in magnitude and less in density. Mr. Ness sketched the period of organic formation, and presently spoke of the consistent parts of coal. These he divided into three—volatile combustible matter, fixed carbon, and ash. In addition, the sulphur and water were worthy of notice. It ought, he reasoned, to be observed that in thus dividing it the value of the coke depended upon the smallness of the amount and the quality of the ash; and that the value of the coal altogether depended on the amount of volatile matter and fixed carbon put together. For gas-making volatile matter, and for heat-producing fixed carbon was essential. As these substances were compound bodies, an elementary analysis would show about 81 per cent. of carbon, about 5 per cent. of hydrogen, about 1¼ per cent. of nitrogen, about 1¼ per cent. of sulphur, about 6 per cent. of oxygen, and 5 per cent. of ash. These were the ultimate constituents, with the exception of the ash, which contained lime, magnesia, silica, iron, potash, alumina, &c. These elements unitedly constituted a variety of carbines of hydrogen which were decomposed by the application of heat, the compounds of carbon and hydrogen being the only valuble products.

After further enlarging as a chemist upon the illuminating properties of coal gas, and demonstrating his position by numerous experiments, in which his audience manifested the utmost interest, Mr. Ness gave a minute explanation of the manufacture of hydro-carbon, in the shape of spirit, burning oil, lubricating oil, and solid paraffin, at the same time showing samples of the cannel from which these were originally taken. Supposing that the coal contained 5 per cent. of hydrogen (which was the minimum), it would, after combustion, produce 40 per cent. of water. The carbon would produce over three and a half times its own weight in forming carbonic acid gas; so that, although these gases were to our view at first sight consumed, they produced over three times their own weight in the atmosphere. The balance of power was kept up by the vegetable creation absorbing the carbonic acid, and giving out oxygen in return. The very able paper was now concluded with some general observations pertinent to the occasion, and the lecturer resumed his seat amidst much applause.

The PRESIDENT intimated that the paper would be printed, and that it would come on for discussion at the next monthly meeting.

MANUFACTURE OF IRON—ON PUDDLING.

BY MR. RICHARD LESTER.*

From the earliest period of history iron-workers have existed. Tubal Cain is represented as the first instructor of the artificer in iron, but it has been worked upwards of 5000 years, and from time to time has had the greatest amount of skill bestowed upon it, but with all this the constituent elements of iron are still unknown. Yet sufficient knowledge is attained to make iron in such quantities that, for really useful purposes, it may be fairly ranked as the king of metals. To enlarge upon its adaptation would be to deal with every domestic article, tools, implements, weapons of defence and offence, the iron rod, the stately ship, the domestic sewing-machine, or the fisherman's hook. I will not further expatiate on the purposes to which iron is applied, but will at once proceed with the methods for its manufacture. The earliest mode of making iron handed down to us was by long and constant refining in a bath of melted oxide, until it would stand the compression of the hammer. Iron in the malleable form was the production of the early artificers, but we have no account of crude cast metal from the ancients. Of late years iron manufacture has made giant strides, the making of small quantities of malleable iron in the shallow hearth is superseded by colossal smelting-furnaces, where the ores are reduced to the metallic state, combined with many impurities. The cast has to be wrought or puddled before it is what is termed malleable iron.

In the years 1783 and 1784 Mr. Cort, of Gosport, invented certain methods of puddling, a process by which iron was really made in larger quantities, and his invention proved of great value, both in his time and to the present generation, so much so that he is styled the father of iron works. Mr. Cort's process was to puddle the crude iron in reverberatory-furnaces, and on sand bottoms. By your permission I will read Mr. Cort's process:—A common reverberatory-furnace, heated by coal, is charged with about 2¼ cwts. of half refined grey iron. In little more than half an hour the metal will be found to be nearly melted. At this period the flame is turned off, a little water is sprinkled over it, and a workman, by introducing an iron bar, or an instrument shaped like a hoe, through a hole in the side of the furnace, begins to stir the half-fluid mass, and divides it into small pieces. In the course of about 50 minutes from the commencement of the process the iron will have been reduced by constant stirring to the consistence of small gravel, and will be considerably cooled. The flame is again turned on, and the workman continues to stir the metal, and in three minutes time the whole mass becomes soft and semi-fluid, upon which the flame is again turned. The hottest part of the iron now begins to heave and swell, and emit a deep-blue lambent flame, which appearance is called fermentation; the heaving motion and accompanying flame soon spread over the whole, and the heat of the metal seems rather to be increased than diminished for the next quarter of an hour. After this period the temperature again falls, the blue flame is less vigorous, and in a little more than a quarter of an hour the metal is cooled to a dull red, and the jets of flame are rare and faint. During the whole of the process the stirring is continued, by which the iron is wrought to the consistence of sand; it also approaches nearer to the malleable state, and, in consequence, adheres less to the tool with which it is being worked. During the next half hour the flame is turned off and on several times, and a stronger fermentation takes place; the lambent flames also becomes of a clearer and lighter blue, the metal begins to clot and become much less fusible and more tenacious than at first. The fermentation then by degrees subsides, the emission of blue flame nearly ceases, the iron is gathered into lumps and beated with a heavy-headed tool, finally the tool is withdrawn, and the aperture through which the iron was worked is closed, the flame again turned with full force for six or eight minutes, the pieces thus being brought to a high welding heat are withdrawn and shingled, &c.

Although the above process made good iron, it had a very good metal to start with, well cleared from many of the impurities which we have to contend with now. But much of the iron was spoiled because of the inability of the workmen to regulate the action of the iron on the bottom of the furnace, it being formed of sand, which drained off the oxide, which was also detrimental to puddling. The next improvement on Mr. Cort's process was the substitution of iron bottoms to the puddling-furnaces; and hereby the liquid bath of the oxide is retained by the iron, although the author of the iron bottom says it was the principal aim of his invention to work the iron in a bath of cinder; in fact, to boil it in a similar manner to the old process in charcoal fires. This part of the business was never carried out till Mr. Joseph Hall, of Bloomfield, Tipton, Staffordshire, brought it into practice. Mr. S. B. Rogers, who was the inventor of the iron bottom, never received much notice till his last years, when he received some gratuity from several of the Welsh ironmasters, but his work still stands, and to all appearance will be a lasting monument of his usefulness, although named "Mr. Iron Bottom."

You will here see that puddling has arrived at its present condition by slow stages, and improvements are being tried continually; but the elementary principle of puddling must be embodied in any scheme for the manufacture of iron if it is to be a success. This is the process I have to treat with to-day, and it is performed as follows:—The furnace is the reverberatory principle, the hearth at the bottom about 2 or 3 in. thick, and around, about 11 in. high, is coated with good oxides. When the furnace is hot enough to charge throw in your cinder or oxide which are found about your hammers or rolls; next charge the iron on the top of the cinder, the aperture of the furnace is closed, and the flame is put on. The charge is then melted in about 30 minutes, but during the melting the workman, with his rabble, breaks up the metal as it softens, and keeps it off the bottom. When the iron is sufficiently clear the damper is closed, which cools the furnace and checks the iron from becoming too hot, and surcharges the furnace with carbonic oxide, which prevents the iron from throwing off its carbon till the whole mass of metal begins to heave and rise; the damper is withdrawn, and the flame put on; the iron is in a state of evanescence or boiling, as it is termed, and the whole of the exertion of the workman is required here to keep the mass well open with the rabble, so that the carbon combined with the oxide may freely escape. The fire upon the grate must be kept solid, and the flame full in every part of the furnace, because any free air passing through the furnace attacks the iron as it begins to come into its mature state, as it is called.

It is at this stage of the process that each granule of iron takes up a fresh existence. The boiling of the iron must be forced as much as possible to its issue to keep the iron from clotting before the carbonic oxide is burnt out. It is also at this point that the cinder, with all its impurities, leaves the iron, hence it is necessary to keep the iron up, so that it shall be well wrought, and free from all deleterious substances. If the iron is not well boiled it falls into a crude or raw state to the bottom of the furnace, and if this be the case it is all but impossible to make wrought-iron of it afterwards. The iron being dropped, it requires the furnace still to be kept full of flame of a hot clear nature, but suited to the temperature that the iron will stand. The iron is now turned over from one side of the furnace to the other till it is sufficiently heated all through to adhere together, when it is formed into lumps, and taken to the hammer, and shingled and rolled into puddled bar. At this point it should be stated that although heat, especially a high heat, such as Bessemer attained during his decarburisation process, is of the highest value, yet it should be borne in mind that any separation which takes place after the boiling ceases is only undoing what is already accomplished—the cementation of particle with particle by the combination of oxides. My opinion is this, that a chemical action has taken place before the iron is dropped, and this is where welding commences. That should never be disturbed, for all cardon that is not required in the iron ought to be burnt out before the iron is settled down. The following is an analysis of the pig-iron previous to and after the Bessemer process:—The pig 1·012 bar, after 1·102; 2d. pig 1·090, after 1·960.

For the further guidance of those who take an interest in puddling, I have drawn up a few rules, which must be attended to when quality is required:—1. Thoroughly melt your charge.—2. Keep it in the melted state some little time.—3. Add carbon by lowering the damper.—4. Keep the fire well up while the iron is boiling, and work well every part of the charge, so as to bring about a thorough union of the iron and cinder.—5. Lower your damper proportionately to the temper of your iron, ball up, and carefully prevent the air or fire-oxygen from passing through the furnace, for it will burn the charge. Inattention to this is the great cause of bad iron. And I now beg, in conclusion, to draw your attention to the analyses and tests of samples of puddled bar made from No. 4 Cleveland pig-iron, which have been brought about by adhering to the above whilst puddling. The hardest of the samples stood a strain of 38 tons to the square inch. B, the softer, stood 38·8 to the squre inch. Now, as phosphorus is generally supposed to be the cause of the Cleveland pig not making a bar of ordinary strength, it was an anxious part of the business to know when it is taken out by the process of puddling, there being a suspicion that the mischief is done by the burning of the iron when it is dropped, rather than by the phosphorus. Besides, Dr. Percy says that the elimination of the phosphorus of iron is a problem of the highest practical importance, and that his opinion is that it comes away during the time the iron is sweating while being formed into lumps. It was necessary to try and find when it did escape. During the Bessemer process, which is similar to the boiling before mentioned in puddling, the analysis of the iron gives more phosphorus than the original pig-iron, and his iron was taken out before it had a chance of sweating. After-boiling shows only slight traces of phosphorus. Therefore, it must eliminate at some stage previous, which must be during the melting. It must escape as phosphoric acid among the cinder, which is oxide.

From the Darlington Iron Company, Albert-hill Iron Works, Darlington, to Mr. R. Lester, forge manager, &c., Messrs. Hopkins, Gilkes, and Co. (Limited):—"I got your sample bars to-day, but cannot think they are made from Cleveland iron only. I tested them very carefully at my leisure time, and find these extraordinary results to be from common stone. You will favour me with particulas, perhaps this next week. Test, &c., as below:—

No. 1 bar = ·88″ × ·80″ = ·7040″; broke at 25 tons; carried 24·5″; = 34·8 per square inch.

No. 2 bar = ·88″ × ·80″ = ·7040″; broke at 25 tons; carried 24·5″; = 34·8 per square inch.

Reduced in section at breaking part to ·82″ × ·74″ = ·6068″.

Yours truly, C. THOMPSON.

Sample marked "A soft"—phosphorus, slight trace. Sample marked "B soft"—phosphorus, trace. HERBT. CROSSLEY.

After the reading of the paper, a very interesting and animated discussion took place upon the different processes which iron underwent during puddling, in which Mr. Hopkins and Mr. Hill, of the Tees Iron Works; Mr. Thomas, of the Acklam Refinery; and Mr. Platts, the secretary, took a prominent part.—Mr. Hopkins thought it was very desirable to continue the experiments that Mr. Lester had made with pure Cleveland iron, and he hoped that other firms in the district would also make experiments in the same direction, with a view of carrying out the objects of the association—the practical discussion of such papers.—Mr. Thomas moved the adjournment of the discussion until the next meeting.—The Chairman proposed a vote of thanks to Mr. Lester for his interesting paper, and stated that on Saturday next the session would close by an excursion to the Eston Mines.

* Read at the Cleveland Iron Trade Foremen's Association.

INSTITUTION OF CIVIL ENGINEERS.

The annual Conversazione of the Institution of Civil Engineers, given by Mr. C. B. Vignoles, F.R.S., its President, took place at the Society's House, Great George-street, on Tuesday, and was very numerously attended. The models exhibited were of a particularly attractive character, and were examined with much interest. The Victoria Stone Works Company showed some excellent specimens of artificial stone; and the Patent Stone Working Company exhibited specimens of stone moulded by machinery, and a model of their new stone-cutting machine. A model of Carr's Disintegrator, which has been already described in the Journal, was shown by Mr. J. P. Richardson. An automatic boiler feeder, a self-oiling journal for locomotive axle-boxes, and an automatic weighing machine were amongst the models exhibited by Messrs. T. Brown and Co.; and there was also an excellent upright boiler-feeder, from Mr. J. C. R. Okes, Associate of Institution of Civil Engineers, which will be referred to hereafter. Amongst the specimens of metal were samples showing the process of iron and steel making, from the Bowling Iron Company. Mr. Parsons' specimens of white brass; a specimen of malleable cast-iron twisted cold, from Mr. W. H. Delano, Associate of Institution of Civil Engineers. Mr. H. Chapman's samples of metal work obtained from a tube by direct hydraulic pressure without an internal die, and Mr. W. R. Roebuck's specimens of compression castings excited much interest. Models of a buddle for separating ores, by Mr. J. H. Williams; of an exhausting machine for ventilating mines, by Mr. J. Cooke; and an improved magneto-electric mine exploder, were also exhibited, and were considered to be of great practical value. The agreeable character of the conversazione was much increased by the pains which the several exhibitors took to explain the objects and peculiar merits of their inventions—an explanation which at many similar gatherings it is almost impossible to obtain. The extent of the exhibition may be judged of when it is stated that the catalogue contained 157 titles in the portion devoted to engineering models and instruments, whilst the works of art division was still larger; and it may safely be affirmed that all who were present had full opportunity of acquiring a vast amount of useful information, as well as much enjoyment.

TUNNELLING MACHINERY.—The specimens exhibited by the Stone Working and Tunnelling Machinery Company were of as good workmanship as could be desired, and it appears that with one of their patent moulding 8000 ft. run of the string course of new St. Thomas's Hospital has been executed. Quarry owners can contract with the company for the loan or gradual purchase of machines for tunnelling, cutting rock out of the quarry, or executing orders for simple running patterns, or squared blocks, &c., on convenient ground near railway stations or canals.

KNOWLES'S WROUGHT-IRON PERMANENT WAY.—The object of this system of way, the model of which was exhibited by Mr. BELLINGHAM, of Bush-lane, is to procure so good a road that the wear and tear of the tyres and axle-boxes, and breakage of engine-springs, shall be reduced to the minimum. The usual timber sleeper is replaced by a rolled and curved plate of wrought-iron, grooved for the reception of wrought-iron jaws, which hold the rail, instead of the present cast-iron chairs. Iron rods, passing from one rail to the other, maintain the gauge of the road, and nuts on the ends of the rods, screwed up against the jaws, lock the rails in their position. Where one rail meets the other longitudinally, the ends are fished by an extra length of jaw, making the joint perfectly sound, but not too harsh. The fibres of the wrought metal in the sleeper, jaws, and rail being all in the same direction, the parts work well together when subject to the action of passing loads, and the rail being suspended in the jaws, the motion is easy, and the hammering and jarring common to the present roads are done away with. Whilst affording greater comfort to the passengers, it is also less destructive to the rolling-stock than any of the present systems. The few parts and its great simplicity are additional advantagess, and the form of the sleeper renders the operation of packing easy. This road, it is believed, will meet the evidently increasing desire to obtain a really permanent way in place of one constructed with perishable material, which must soon be discarded on our principal home lines, where economy can only be attained in conjunction with thorough efficiency. Although the first cost of a road upon this system may be somewhat higher than others, it is claimed that it is by far the cheapest in the long run. By careful and honest calculation it is found that a timber sleeper road for the same weight of rail might be laid in this country for about 120l. less per mile. This saving in the first instance is most insignificant when the duration of the wrought-iron road is taken into account. With regard to use in India and other countries, where wood quickly perishes, its cost, including freight, is about the same as cast-iron pot sleepers, while the great saving in carriage up country, and the total absence of the loss caused by breakage in transit, which is very great with cast-iron pots, renders it much more economical.

SAFETY LOCKING SWITCH.—An improved safety locking switch, combined with locking signal apparatus for railways, was exhibited by Mr. JOHN BRUNTON, M. Inst. C.E., of Great George-street. The motion of the cams which move the points brings up a block or wedge, which, when the motion of the lever is completed, effectually fixes the switch or point in its position; but before such movement of the points-lever can be made the pointsman must move the distance signal to danger, and block the line; and, further, the movement of the points-lever must be complete, and the switches locked or wedged before he can move the other signal-lever, and show the "all right" signal to the train advancing to run into the branch line or siding. It is claimed that this mode of working the points and signal apparatus ensures that the switch or point, when either completely open or closed, shall be so fixed in its position that the vibration of the passing trains, even at high velocities, shall have no tendency or power to alter such position; that the signals indicating the position of the points shall be so arranged that it is out of the power of the pointsman to make any error, such as showing "main line clear" whilst his points are open to the siding or branch, and *vice versa*; that the arrangement of the signalling and points-locking apparatus should be such that each of the three movements necessary for the whole operation—blocking the main line, moving the points, and opening the siding or branch, or *vice versa*—must be complete before the next movement can be made, and that the order or rotation of these movements cannot be interfered with by any carelessness on the part of the pointsman. It is maintained that if the distance-signals of station sidings or branch lines were thus intimately connected with the points on the main line, and by their arrangement unerringly showed the danger signal to approaching trains until the points were fixed in their proper position, many of the late lamentable accidents entailing the loss of life and property would have been averted. It is further submitted that with such an arrangement as is thus proposed the danger of facing points is reduced to a minimum, and their larger application, now so studiously avoided, would be followed by increased facilities for the shunting of goods trains, and by it the saving of much time and risk would be secured.

TWIN PASSENGER STEAMER.—In connection with the proposition which has recently been made for carrying railway trams bodily across the Channel to France, the invention of Mr. ANGELO J. SEDLEY, of Conduit-street, was particularly interesting. The dimensions represented are—length between perpendiculars, 432 ft.; extreme breadth over paddle-boxes, 97 ft. 6 in.; depth underside of pontoon deck amidships, 22 ft. 6 in. There are eight cabins on main deck, each 50 ft. long by 22 ft. 6 in. wide, and 15 ft. high, with arrangements for separate sleeping cabins above, reached by internal staircases, and there is a promenade or fair-weather deck 300 ft. long and 60 ft. wide. The railway alley is 26 feet wide and 300 ft. long, and has three lines of rails. Mr. Sedley uses 40-ft. paddle-wheels, 16-ft. breast, driven by 500-horse engines, with dry steam 250 lbs. on the inch, using distilled water, and working on Perkins's system up to 3500-horse power, on a consumption of 1½ lb. of coal per indicated horse-power. The steering is effected from the bridge by hydraulic or steam-power. The total weight, everything on board, is calculated at 1600 tons; he anticipates a speed of 25 to 30 miles an hour. The inventor regards his vessel as the ocean steamship of the future, and describes her as a twin boat with deck houses built upon her turtle-shaped back or deck, which will be well protected fore and aft from seas that might break over her, with bulwarks also of great height, sufficiently strong to resist the impact of a monster wave; built in compartments throughout, she might be made practically unsinkable, and calculated from the form of the hull or pontoons to rise easily over broken water. Drawing but little water, and upheaved on to the surface by the section of the hull, propelled by paddle-wheels, one on each side, and one astern, with proper engine-power, "she would walk the water like a thing of life," at a speed unknown and unheard of in the present day. In this commodious vessel, of from 12,000 to 20,000 tons, would be found a floating palace, decorated with some regard to the laws of good taste which will at that period obtain. And in this palace will be found all the agrêmens and delights of fashionable and domestic life ashore, with the bright inspirating and exhilirating influence of the sea, when sea-sickness is no longer to be dreaded. In the vast interior will be found a range of shops for all those various fancies which the fair sex mostly affect; a newspaper and post-office, spacious promenades, open and covered, a theatre and ball-room, a library and smoking-room, baths hot and cold, and lastly a drawing-room, luxuriously fitted, surrounded by private apartments, and containing each a sitting-room, with bed-rooms above, which are approached by interior staircases, all nicely arranged with a view to comfort. This ship of the future is to be driven by paddle-wheels, one on each side and one astern, cycloidal and segmental in form, with the best then known system of feathering, so as to give the maximum of effect with the minimum of power. The engines to drive these paddle-wheels, and also to steer the boat, shall be 450-horse power, to indicate 5000 actual, will be reciprocating or rotary (rotary preferred), made of the best materials, and highest finish, so far as regards the working details; the whole construction to exhibit the least number of moving parts, and the utmost practical and mathematical accuracy possible. This engine shall be actuated by an inexplosible generator, making clean dry steam, conveyed into it 200 lbs. on the square inch, working expansively through two grades. The generator will be heated by liquid fuel, made either from the substances now in use for that purpose, or from some new untried material, largely combined with salt water, and manufactured as required. And, lastly, the vessel would be lighted from stem to stern by refined gas, forming at night a grand illumination. There would be also two or more centrifugal pumps, each discharging at least 10,000 gallons a minute, ready at a moment's notice to put out a fire, stop a leak, to steer the vessel, or assist in propulsion, in case of a break-down of the engines.

GUNPOWDER SUPERSEDED.—An improved machine, the invention of Mr. J. GRAFTON JONES, for breaking down coal, superseding the use of gunpowder and hand-driven wedges, was exhibited. The principle of these instruments, and their mode of application, was fully explained in the Journal. This machine, which is of power sufficient to break down or lift the strongest coal (after it has been holed), is now so much improved that it can be inserted into a hole only 2¼ in. in diameter, and with it one man exerts a force equal to a pressure of 200 tons, while its weight complete, including the wedge or pressing blocks, does not exceed 40 lbs. This truly wonderful result has been arrived at by repeated improvements in construction, which consist in substituting for the ordinary force-pump (the valves of which cannot be made to sustain the great pressure required) a screw pump, and screw conical steel plugs in place of the usual valves; these plugs have been proved to hold water-tight against a pressure of more than 100 tons to the square inch. The introduction of this screw pump and of the plug valves has reduced the weight to one-fourth of what was necessary to obtain the same power with the best plunger pumps. Mr. Grafton Jones has constructed larger machines than the one exhibited (the weight of which is less than 1 cwt.), with which coal has been pushed out of the solid, thus in many seams obviating to a great extent the necessity of loading the coal. Mr. Grafton Jones may be congratulated on having at last achieved a success. The holes into which the machines are inserted can be put in with the improved drill in from five to fifteen minutes, according to the size and nature of the mineral.

DIVING APPARATUS.—The efficiency of Mr. SIEBE'S diving apparatus has long been acknowledged, and at the conversazione on Tuesday an opportunity was afforded for examining the several parts of the apparatus. In some recent experiments at Chatham Dockyard air was supplied to both the divers by means of the one pump, and after walking a considerable distance, and remaining under water some time, the divers returned to the surface, both stating that they were furnished with abundance of air, while neither suffered the slightest inconvenience. Not the least of the advantages of Mr. Siebe's invention is the fitting of the diving apparatus with a self-acting pressure gauge, which registers the pressure in pounds, while a submarine lamp can also be applied to the pump, by which means the diver can be assisted by a steady light when employed in exploring the interior of a vessel, or descended to any depth to which the light of day does not penetrate. The Admiralty diver subsequently descended to the great depth of 108 feet with the two cylinders of the air-pump connected, followed to the same depth by Sergeant Baker, of the Royal Engineers, who made his first descent, when, even at the depth and under the conditions stated, not the least inconvenience was experienced by either of the divers, who remained down for some time, the valves, gauge, register, and other parts of the apparatus all working most satisfactorily. The officers and men at the Royal Engineer establishment will commence their summer course of practice in diving operations with Mr. Siebe's apparatus and the improved air-pump.

THE NEW TIMBER SLEEPER PERMANENT-WAY.—The models of Mr. FEATHERSTONE GRIFFIN'S economic permanent-way are certainly entitled to be classed amongst the most attractive exhibits connected with railway materials. Mr. Griffin claims that the advantages of his new system over that of a first-class transverse timber road are based upon well-known scientific laws. Instead of wasting the most vital principles of a good road—the largest proportion of rail and sleeper bearing surface, and having the fastenings placed as they are now, subject to tremendous strains and leverage, the injurous effects of which, natural and artificial causes, are ever tending to augment, by decaying and loosening them—they are by Mr. Griffin's system entirely economised, and the maximum value of each separate part is obtained, and, as far as it is possible, preserved; moreover, they so much more closely unite in their application that with considerable less weight of material far greater strength and security are given to the whole structure; and, at the same time, the injurious effects of the natural and artificial causes of failure are reduced to a minimum. The rail, instead of having but a few inches of bearing upon each sleeper, has such a large amount of support, is so much more firmly held, and its tendency to turn, or buckle, is so completely prevented by its enclosed position, and the immense force of the grip upon it, that, whilst having far more available wearing surface, at least 25 per cent. less weight is necessary, and its maximum strength is obtained by a minimum increase of weight; moreover, with more or less advantage, this system can be adapted to almost any form of rail, though it would be difficult to devise one more troublesome and expensive to keep in proper position than the double-headed rail ordinarily used in this country, it having about the same aptitude as an egg to stand in the position it should naturally assume. It is considered that for steel rails this system is especially valuable, from the form of the head allowing (from the great support given) a much larger amount of wear upon it, and from the impossibility of breakage, or derangement of the fastenings, a line would require fully 50 per cent. less cost of maintenance in-

quartz, I believe the loss has been from $500 to $800 per month. The water-charge has been very easy—about four barrels per hour in the summer months. The depth of the mine is about 240 ft., the length of mineral ground 140 ft.—average, about 6 in. wide, and barely 1 oz. of gold to the ton of quartz. It will cost $18 per fathom to blast the rock; value at 4l. sterling to the ounce, and cost of blasting 3l. 12s. How, I would ask, is it possible that this mine can pay cost, when you consider other expenses, such as filling, landing, horses, carriage, crushing, agency, &c.? The cost of crushing alone is 2l. per ton. They are erecting a new crusher on a part of the property which was worked some years since by an English company at a loss of 40,000l. They have commenced to sink the main shaft in one corner. The length of the property is 1050 ft., by 250 ft., and 5 ft. wide. They have, therefore, that distance to drive a tunnel west and north to prove the different lodes.

6.—I proposed to the company to sink the shaft in the centre of the property. By doing so they would be enabled to work three different lodes almost at once, after the shaft had been sunk to any depth that might be determined on, and would prove the property for less than one-half the capital it will cost by the present mode. Such waste of capital in erecting buildings and machinery on the surface I have never seen before in any country, when every economy should be used for the working of such small veins.

7.—In looking over the property of the Stirling Gold Mining Company, and the manner in which they have commenced to spend the money, I would recommend the company in London to send out a practical man whom they could trust to give them a faithful report before they go too far in proving the property in its present state.

8.—I have been engaged as a practical miner upwards of twenty-five years, fifteen years of which time I had the management of two of the largest tin mines in Cornwall. I find that anyone with practical knowledge of mining is of no account; nothing but theoretical engineers will do for the working of mines in this province, with captains who have no experience in mining. They seem to be afraid to let contracts, because they do not know the price of a foot or fathom of ground; consequently, the mines are worked by day's pay. If the mines of Cornwall and Devon were worked on the same principle scarcely any of them would pay.

April 25. A Practical Miner of Thirty Years' Experience.

MINERAL WEALTH OF COLORADO.

Sir,—Ever since the Paris Universal Exhibition of 1867, at which Colorado ores received the gold medal prize against ores from all other parts of the world, European capitalists have been giving their attention to the Territory for the purpose of verifying themselves the extent of her mines, their character, and the facilities afforded for the profitable employment of capital. The country will bear inspection; consequently the reports and representations of competent persons sent from Europe, and the reports of the Government Commissioners sent by the United States, fully confirmed all that has been said of it.

We find by these reports that the mountains are seamed with mineral in certain directions. A belt of about 20 miles in width runs through the territory in a direction of north-east by south-west, which is so thrown into view by the formation of the mountains, that already quite a number of rich mining districts are located on its line. This belt contains gold, silver, and other minerals, but is as yet only worked for the precious metals. The ores in the different districts differ somewhat in appearance, but are all more or less sulphuret ores, being a class specially adapted for smelting. These mountains seem shaped by nature positively into the most convenient forms for the easy and economical extraction of their riches. They are thrown up into ranges of hills rising 2000 to 4000 feet from their base, and almost invariably bounded on one side by an inexhaustible creek or river, available for power for driving machinery for dressing the ores, or other purposes. From the formation of the mountains, several adits can be driven at the same time, to cut the lodes at varying heights and depths, and the mines thoroughly opened in an inconceivably shorter time than by means of shafts sunk from the surface. By these adits or tunnels the mine drains itself, and the ore is easily and cheaply delivered at their mouths by tramways, from which, by means of a wire aerial railway, they are carried to the foot of the mountain to the dressing works; the heavy and constant expense of fuel, pumping, and hauling machinery being entirely done away with.

Colorado only requires capital, smelting works that will properly and economically treat her ores, and cheaper labour, when she will, as stated by the United States Commissioner of Mineral Lands, in his last report to his Government, "rapidly advance in wealth and power." But with interest at 3 per cent. per month, smelters who charge $50 per ton (2000 lbs.) for smelting, and guarantee merely 80 per cent. of the contents, saving only gold if treated for gold, silver if treated for silver, wasting the copper, lead, zinc, &c., and labour at $3 to $4 per day, she has steadily, year by year, continued to advance in wealth, civilisation, and population, in spite of these drawbacks, a proof positive to the most sceptical of the undoubted richness of her mines, for had they not been as represented, the Territory would have remained a *terra incognita*, as it was little more than 12 years ago. The first discoveries of gold was made in Colorado towards the end of 1858, then the Territory could only be reached by wagons over a road of 700 miles; no stage or mail communication whatever; no settlement within hundreds of miles, no habitations, no roads, nothing but wilderness. Now she is peopled by tens of thousands of inhabitants, in instantaneous communication with the world by telegraph. In daily communication with all parts of the States, and within five days of New York by railroad, her cities are equal to any in the world for their age, and superior to anything we Europeans can imagine to have been built and populated in the short space of 12 years. The resources, then, of a country which has so prospered, under such disadvantages, must be more than ordinary.

Colorado possesses fuel in abundance, forests clothe its mountain sides, and inexhaustible beds of excellent coal lie at their feet, fit for smelting or domestic purposes, which nature has again placed in the most available manner possible for extraction, the coal beds being upturned at the base of the mountains, and by merely tunnelling a few hundred feet in, several excellent beds of coal may be reached. Natural deposits of carbonate of soda exist; one remarkable lake, a few miles from Denver, is so strong that it will yield 50 per cent. of the crude carbonate, sufficiently pure for metallurgical uses; numerous salt springs occur in the mountains, and fluor-spar in abundance. These three minerals, in conjunction with coal, seem to have been purposely placed by the allwise Creator in close proximity for the purpose of utilising the vast metalliferous riches. Iron, copper, lead, zinc, and other valuable minerals abound in Colorado, but, from the great profusion of the precious metals, occupy little attention at the present moment.

What is most remarkable is—that all this wealth and prosperity are within eighteen days' travel from England, not in an unhealthy wilderness, inhabited by savages speaking an unintelligible language, but in a land governed by constitutional laws, peopled by our own descendants, speaking our own tongue, and possessing a most salubrious and health-giving climate.

It cannot, then, but be desirable that those seeking new investments, or desirous of emigrating to a more prosperous region than over-crowded Europe, should devote some attention to the mineral, agricultural, and grazing resources of Colorado.—*British and Colorado Mining Bureau.* Wm. Cope.

MINING IN CALIFORNIA.

THE GRASS VALLEY CONSOLIDATED.

Sir,—If it were possible, I would like to stimulate the shareholders in this mine to more active operations. I am satisfied, through recent discoveries and improvements, that they are in possession of a permanent dividend-paying mine, and I am really sorry to see things carried on so tardily. When Colonel W. O'Connor Sidney put me in charge I had a hope ere this our mill would have been erected, and that we should be in a position to crush our rock, so as to save the cost of hauling the rock three miles to a customs-mill, and enable the shareholders to declare an early dividend; but through such slow progress my plans and calculations remain in *statu quo*, and for want of means nothing at present can be altered—a circumstance much to be regretted, the more especially when we look at the cheering prospects we have before us. Some few days since the mine was visited by Capt. Evans and Capt. Scadden, who very much liked the situation of the mine, also the character of the rock we are taking out, and appeared satisfied as to its quality. We shall commence crushing on May 2, computed, 70 tons of rock, supposed to be a very high grade, as it contains a large percentage of visible gold. I sincerely hope that the colonel's exertions will be attended with success, and in a few weeks at least everything connected with this lucrative mine will be seen in full operation.

Grass Valley Consolidated Mine, April 30. T. Faull, Superintendent.

MINING IN CALIFORNIA.

GREENHORN MINE, GRASS VALLEY.

Sir,—During the past two weeks the above mine has been twice inspected by Capt. Francis Evans, a gentleman I presume well known to the mining capitalists in London. His inspection had something to do with my supposed fabulous reports which recently appeared in the *Mining Journal*. From the fact I could wish it to be distinctly understood that my object in writing to the Journal is not to deceive, but, if possible, to keep the public from being deceived; therefore, you can well imagine my feelings on meeting with Capt. Evans, who will return to England prepared to endorse every word of my reports, also bearing with him specimens testifying as to the richness of this valuable mine. He thinks—and rightly, too—that so far as this mine has been developed it has proved equally as rich as the Eureka, and suggested that the name Greenhorn should be changed, and a name worthy of its merits given to it. Henceforth the mine in question will be known as the Eureka Consols.

Since Captain Evans's arrival in Grass Valley he has been assiduous in his duties, having inspected and examined quite a number of mines, which will on his return to London enable him to render some valuable information, and give a good account of his stewardship. The mines thus examined by Capt. Evans will be noticed in my future letters to your valuable Journal.

Eureka Consols, Grass Valley, April 29. T. Faull, Superintendent.

THE PEN'ALLT SILVER-LEAD MINE.

Sir,—Mr. Henry Sewell, consulting engineer to the Dylluan Copper Mine, is good enough to promise some account of his visits to mining properties in Wales, but I am at a loss to discover any advantages arising from the information he intends to communicate if it be no better than that contained in his last letter. He refers to the Pen'Allt Silver-Lead Mine as being in what has always been considered as a copper country; and, with a judicious regard to the interests of the mine with which he is associated, he hopes that the discoveries of lead at Pen'Allt will be advantageous to the copper yield at Dylluan, and at the neighbouring copper mine too. This is a sort of damning with faint praise, that shows Mr. Sewell to be but a poor sort of guide, and if his judgment is no sounder with regard to the other properties he visits it will not be worth very much, engineer though he be. The Pen'Allt hill may contain copper, but its principal deposits are argentiferous lead of a high standard of quality. They have been found at no fewer than six different points, though up to date the lode at No. 4 cross-cut had not been struck. Without giving those places the names that appear upon the company's plans, I may say that, commencing near the manager's house, and proceeding eastward, the lode crops up to surface near the turnpike-road, and the opening may be seen by every passer-by. Then there is No. 1, extending the whole length of the sett, fully a mile; 60 feet higher, or thereabouts, is No. 2, and on each of these lodes rich openings have been made, from which ore is being extracted to nearly the extreme east of the sett. From the winze below the No. 3 the like class of ore is being won, and at No. 4 cross-cut, where the lode is in hourly expectation of being cut, all the appearances are highly favourable. The lowest estimate of the value of the ore is 15l. per fathom, while from No. 1 the estimate is 30l. per fathom. No veins of copper, or only very partial signs, have yet appeared; and from the experience already acquired it is as certain as anything in mining can be that the space between the two lodes already opened will prove to be a solid vein of the richest argentiferous lead, from 25 to 30 feet in width, and not much less than a mile in length. Besides this, there is the great counter lode as yet untouched, and a lode, believed to be upwards of 60 feet in width, close to the summit of the hill. These conditions subvert the idea of this being a copper country.

Being at Pen'Allt, it would only have been becoming in the consulting engineer to the neighbouring, but yet unproductive, Dylluan Copper Mine, while professing to narrate the experiences of his visitation, to have referred to what the company have done during the few months they have had possession of the property. I will endeavour, though imperfectly, to supply the omission, and everyone visiting the spot can see for themselves whether I state facts or not. The water-wheel is nearly erected, the stream has been prepared by damming, and launders for turning it, the crusher and rollers are in process of fixing, patent dressers are contracted for, and in three weeks the incline from the adits and openings of the mine to the wheel, which is to convey the ore to the crusher, will be ready. By the end of the current month the practical operations of the mine will be commenced, and lead will be produced in sufficient quantities to enable the directors to pay a dividend for the quarter ending with September—that is to say, in less than nine months from the purchase of the property.

This will decide the question which Mr. Sewell has started upon imperfect acquaintance with the locality, whether Pen'Allt is in a lead-producing mountain. As to the estimation in which it is held in the market, the present price of the shares is an untrustworthy criterion. Certainly those who rely upon it will find themselves mistaken if they take it to indicate the value of the property. All lead mining shares are for the time unduly depressed, but it should be remembered that there is a reaction in all things, and that sound undertakings, such as Pen'Allt, will ultimately justify themselves before the public.

London, June 1. J. B. H.

AGENTS' SALARIES IN WALES.

Sir,—I observe in last week's Journal that Mr. Henry Sewell has again brought to public notice the miserably low salaries which many public companies pay their agents in the Principality. I know that I shall be expressing the mind and feelings of a number of agents here by thanking that gentleman for the kindness he has shown towards us in bringing before the public a question which, to us, is of so much importance.—*Llanidloes, May* 31. John Roberts.

MINING IN THE NORTH OF CORNWALL.

Sir,—This portion of the county appears at length to be about to receive the attention which its great mineral wealth demands. The beginnings now made will doubtless result ere long in much profitable enterprise in this district, and it will soon be a matter of wonder why it was so long neglected. Two or three causes especially seem to have led to this neglect. The Cornish miner of half a century ago, in his search for tin, copper, and lead, seems to have regarded nearly all the other ores as of little or no value; and so he often threw aside on his attle heaps ores of more value than either of them. In the case of Old Treburgett, for instance, it has been demonstrated that *silver ores* of great richness were cast away as worthless, and such ores may now be gathered out of the loose stone walls which divide the pitches, and from the old heaps about the mine; and the traditions of the neighbourhood relate that they were even broken up to mend the roads. The Cornish miners appear, too, to have been ignorant in those days of the great value of their lead ore, from the large percentage of silver it contained; and it was sold simply as *lead ore*, for about 8l. per ton—less than one-third of its value, as has lately been shown by actual sale of ores from the very same mines.

Yet, even with these disadvantages, mines in this quarter of Cornwall are known to have paid good dividends down to a certain depth of working. Then, another cause presented itself to the miner for abandoning his enterprise—the large increase of water overpowered the means he had for freeing himself from this obstacle to his operations. He might have freed himself from it, indeed, by the aid of large and powerful engines; but the expense of such engines was great, especially in those days, and the rate at which he sold his ores did not encourage him to incur so great an expense. It thus happened that good mines were abandoned when carried to the comparatively small depths of 50 or 60 fms. only. But why, it may be asked, has the working of them been left so long in abeyance? Doubtless, from the first cause I have named—the great richness of the ores not being known.

But now all this is changed; the large percentage of silver in the lead ore has been demonstrated, both by assay and sale, and the true silver ores have received their due recognition; and, still more, not only has this been shown to be the fact in the case of old mines, but wherever new lodes have been opened the lead ore has been proved to be of similar richness in silver. A new lode, for instance, has just been broken into by a company who, in their greed for gain, have dared to invade the very sanctuary of romance—the rock on which stands the castle of Tintagel, in which the Knights of the Round Table held their high carousals. To propitiate the shades of these, and of the prince of all chivalry, they have wisely adopted the title of "King Arthur" for their name. As to the gain they seek, truly they seem likely to achieve it, for almost at the first stroke of the pick they appear to have laid open a leader of solid silver-lead ore, 6 to 9 inches in thickness. What, then, may they not hope for as they descend in depth? The very gossan of the lode, moreover, seems to be rich in silver, and by actual sale has brought 3l. a ton.

This company I see proposes to carry their workings, not only into the land, but beneath the sea, and to undermine, it may be, the mystic realm of Lyonness itself. Whisper it not to Tennyson, lest the wrath of his muse be kindled, and vent itself in a withering ode on the *argenti sacra fames.*

But to leave the domains of romance and poetry, and to return to the question we started with—the mineral wealth of the North of Cornwall—the cases I have named are but specimens of the general character of the district. The mineralogical formation, generally, is favourable for silver, as well as for silver-lead, and I unhesitatingly predict that before many years are over this part of Cornwall will be attracting more attention, and calling forth more enterprise, than either Wales or Shropshire. Cornubiæ Amicus.

[For remainder of Original Correspondence, see this day's Journal.]

Metalline—A New Invention.—A number of scientific and practical gentlemen, connected with manufacturing and other machinery, have been for several months watching the operations in this city of an invention that aims at the entire abolishment of oils and all other lubricating material for boxes, slides, and every condition of motion where metallic friction is to be overcome or expected. It is claimed that such a result has been fully achieved, and there are engines now running with this material, that the proprietors aver have worked to complete satisfaction for weeks and months. Such, in general terms, is the claim of this novel invention. It is the work of a scientific and practical gentleman, well known here and in Europe, who has spent a great many years in the study of physical forces and their effects, with especial reference to metals. The exact nature of the present invention cannot be given, for the reason that patents are being sought for in several countries in Europe, and any clear description of the materials and processes would be likely to defeat that end. It may, however, be said, in a general way, that the discovery—which has received the name of metalline—consists of such combinations and manipulations of various metallic substances as to make a surface on which the ordinary journals, axles, crank pins, slides, &c., of iron, steel, brass, or any other metal, will run with much less friction, without heat that comes within the slightest possibility of danger, and without increase (in fact an actual decrease is claimed) of the motive power used. Those, briefly, are the claims, and the inventor refers to a large number of trustworthy gentlemen who have examined and tried the thing, and speak from actual knowledge. Supposing this invention to do what is claimed for it, the wide extent of its use and its real value to the world may warrant the statement made by an eminent engineer, that its importance is above that of any of the great discoveries of the time. In the silk, cotton, and woollen mills of this country alone, the use of oil subjects manufacturers to large losses on goods spoiled by it, to spontaneous combustion where it is not constantly watched, and to heavy expenses for the cost and application of lubricants. On railroads disastrous accidents have often occurred, and annoying delays have been endured, from hot axles; and wherever wheels revolve we hear shrieks for grease that indicate neglect, superfluous wear, and perhaps immediate danger. Now, if we could run axles of Bessemer steel in boxes of Rockland Lake ice, the dangers, delays, and detentions of friction would be avoided. If this metalline proves to be all that is claimed for it these same losses and dangers may be avoided by its use. We are told that a company has undertaken to put this discovery in practical use in a public way as soon as the proper arrangements can be perfected. How far this invention will fulfil these conditions remains to be made manifest to the public.—*New York Bulletin.*

The Royal School of Mines, Jermyn Street.

Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

Lecture XLIV.—I have now to bring before you a good deal of apparatus of a mechanical kind, which has to be employed in the shafts of a mine, and according to the depth from which the mineral has to be lifted, and the quantity that has to be raised, the power employed will be the result of animal or manual labour, or of steam. Amongst these certain things come into play largely in particular mines, and to a small extent in others. Thus the windlass is employed to a great extent in metalliferous mines, while in collieries and in working stratified deposits it is scarcely ever to be seen. It is a machine of a very simple character, and dispenses with all sorts of apparatus and the friction produced thereby. To a moderate depth, and with small quantities of material to be operated upon, it is very efficient, and unattended with risk. Why then, it may be asked, are not windlasses employed in working stratified deposits? Because in the latter the apparatus for drawing is necessarily concentrated at one or two points, the weights to be lifted are very considerable, and the speed required necessitates a class of machinery as good and as perfect as can be. The circumstances under which metalliferous deposits are worked are, besides, very different to those which are stratified, not only as to drawing, but in the immense amount of work going on. Up to a certain point they are much alike, but as a vein is opened level after level is driven out, and the workings are spread over a large area, with after all, as compared with a colliery, but a very trifling amount of "get" at each working place. But recurring to earlier operations, as, for instance, in the case of shode pits, which may be put down in two or three places at once, and levels driven from one to the other. After a while one of these pits may become the engine-shaft, and the first working level, we will suppose, is at 60 fathoms. It now becomes of the highest importance that the plans are well devised, and that the engine-shaft should be as central as possible. As the levels are driven and winzes sunk from the one to the other, the material is wound by means of windlasses through the winzes, and so by the levels to the shaft. Working places in a large metallic mine are often from 100 to 200 fms. away from the drawing shaft, and it is often a question whether machinery should not be introduced, or whether a number of winzes should be sunk and worked by windlasses, a condition of things which in the last century used to be extremely common, so much so that in a large proportion of mines winding the mineral and water was the heaviest part of the expense. I have known cases in which half the men were employed in winding, and thus absorbed a considerable amount of what might otherwise have been profit. When this occurs it naturally strikes at the root of the system, which can only be defended while it is employed in what may be called the preliminary work of driving the levels when the one below is worked from the one above, and the material is raised by manual labour from one to the other, and then carried by some cheap mode of conveyance, such as hand wagons, to the shaft, by which it is raised to the surface. When, however, a mine is in regular work, and you see in going along the levels a number of windlasses at work, you may be sure there is something wrong, and that, either knowingly or unknowingly, economic principles are not properly carried out. I do not say that mines worked systematically and judiciously may not have to employ windlasses somewhere, as, for instance, when in driving a lower level a winze is sunk from above for ventilating purposes; but work of this class requires on the part of the men no particular skill, and in most cases the men employed are simply labourers, and not skilled miners. In other cases where the ground is hard, and no great quantity can be broken down in a day, the miners themselves will wheel it to the winze, and raise it themselves.

Before we take a glance at the modes in which the mineral is raised, it will be necessary to say a few words on the ropes and chains used with the wheel and axle, worked by human labour, or horses or mules. Of ropes made of vegetable fibre of some kind, twisted in various ways, those most common have three strands of hemp, saturated with tar to one-sixth or one-tenth of their weight. A great many years ago in the colliery districts it was found advisable, for the sake of convenience, when one turn of the rope laps over the other to employ flat ropes of hemp, which were made by attaching two and sometimes three of the ordinary ropes together. A great advantage was then gained when employed at considerable depths, because when the rope is passed over and over again around itself on a drum the leverage on the pulley differs at different parts of the descent. At the first starting, suppose there be a given weight at the bottom of the rope to be raised, that weight will then have its utmost effect, but as the rope winds up the strain grows less and less, until at last, when the weight has been brought up to the surface, the wheel will have a greater leverage, and the engine also be able to deal with the weight more easily, because the weight of the rope is taken off from the weight of what has to be raised. And so in going down the deeper the weight gets in the shaft the greater the strain becomes; and to make the most of this circumstance it is usual to employ narrow drums with flanges, to prevent the rope slipping off at the sides. There are other vegetable materials besides hemp used for ropes, which are supposed to be cheaper, but which, when taken in connection with durability as well as cost, will probably be found to have no advantage in that respect. Amongst these one of the most useful is the fibre of the aloe, which is not only used in Mexico, where it grows with the greatest luxuriance, but has also been tried in some of the German mines, with no advantage, probably, as to weight, but it is said with a certain amount of economy. Of course, the weight of the rope is a great addition to the weight of the kibble, and many devices have been tried to lighten them, amongst which is that of tapering them. Thus the upper part is made thicker and stronger, because it has to bear the whole strain, while the lower part has only the weight of the kibble and its contents to carry, and in this respect aloe fibre is said to afford some advantage. In the Spanish peninsula esparto grass has lately been much used. At first it goes very much against the grain to get on a rope of this material, and considering the shortness of the fibre it certainly seems rather dangerous, but in districts like the South of Spain and Mexico it is a material which must not be neglected on that account, because its cheapness and the facility with which it can be obtained gives it great advantages. It must be remembered, however, that in these countries there is a great deal of windlass work, and for that purpose grass ropes are much used. About 1830, however, it struck some of the miners of the Hartz, who have to deal with great depths, that these vegetable fibres might advantageously be replaced with iron wire; and after some experiments wire ropes were adopted, and their use quickly spread through the mines of northern Europe. Strange to say they came last into vogue in England, although here hemp is dearer and iron cheaper than on the Continent. It was found on the Continent that, although iron is not particularly cheap, as compared with hemp, nevertheless great economy resulted from the use of ropes made of that material, partly on account of its durability and partly in consequence of its lightness, as compared with hempen rope. The person who introduced iron wire ropes into England was Mr. Lewis Gordon, who entered into partership with Mr. Newall, and laid the foundation of the well-known firm of R. S. Newall and Co., who took out a patent for the invention. The practice of employing wire rope has since become very extended, not only in mining operations, but in the rigging of ships. It has not, however, thoroughly taken root in metalliferous mines, owing to its advantages not being understood, and to the circumstance that its application has not been attended with that care which is requisite to realise the full amount of economy from it. It is obvious that a rope consisting of a few wires must not be brought too rudely into contact with the sides of the shafts, and that it must not be wound too shortly over the pulleys. It is impossible to give wire rope a fair trial if pulleys of only 1, 2, or 3 feet diameter are used, as was frequently the case in metalliferous mines. The diameter of the drum should not be less than 5 or 6 ft., nor should the pulley be of less dimensions. If the shafts are very irregular in form, rollers ought to be employed to keep the rope from rubbing against the sides. Wire ropes are made of different forms and sizes. In some instances they are composed of many small wires, closely twisted together, whilst in some districts, as in Hungary, they are made of few wires of larger diameter, and very slightly twisted. You will readily understand that if wire be twisted as sharply as hemp, it would be very apt to break, and I believe that in many instances wire has been twisted to a greater degree than it is capable of, consistent with safety. Flat ropes have also been made of iron wire, and this variety has had a very extensive run for many years in collieries, and from their first introduction up to the present time it is thought there is no kind of rope equal to them. They are very much lighter than hempen ropes, and have the advantage of overlapping one turn upon another on the drum. Another advantage attending them is that which also applies to the flat hempen rope—that there is a much greater regularity of motion in the shaft, instead of the constant contortion and twisting in the case of round ropes.

Considerable prejudice was felt towards the wire ropes on their first introduction, owing to the reluctance of the men to trust their lives to so slender and apparently so weak a support; but, nevertheless, the good work effected by them soon make them to be valued by the miners. In the case of very deep mines, it would be almost impossible to carry on the workings unless wire ropes were used, in consequence of the very small quantity of material they would be able to raise if any other kind of rope be used, on account of its greater weight. Steel ropes have also been brought into use in this country and Prussia, and so far as they have been experimented with they have given satisfaction, but they have not been adopted on a sufficiently large scale to judge positively of their merits. Steel being of smaller diameter than iron, greater care is necessary in seeing that it does not pass over so small an angle as to snap it, and that it should not come into contact with the rocky sides of the shafts. Chains of various kinds have been largely employed for drawing loads in shafts, more especially in metalliferous mines, and there is at all events this great convenience about chains, that they may be allowed to pass over pulleys of comparatively small diameter, that less damage will result to them by coming in contact with sides of shafts, and that with chains several shafts can be served by one engine. Single-link chains, with whatever care they are used, are very liable to break, and if only one link be of inferior quality, it will be just as disastrous as if the whole chain be of the same character. Besides, it must be remembered that chains, rubbing as they do over a large number of guide pulleys, are subject to that change of structure which has been so often commented on in respect to the axles of railway wheels and other wrought-iron articles, that although the iron may when manufactured be of a tough description, yet after a time it becomes brittle. Another variety of chain, which is extensively in use in the central districts of South

Staffordshire, Worcestershire, and parts of Shropshire, is the three-linked chain, a very strong but at the same time a very ponderous chain, having the appearance of a flat rope. One advantage possessed by this chain is the extreme improbability of the whole of the three links breaking at once, whilst if one broke it falls out of position, and is at once observed. I have heard of one or two cases of chains of that class being wholly fractured, but they are exceedingly rare. The chief objection to their use is their very great weight, being from 10 to 16 or 20 lbs. to the yard, hence it may be readily conceived that when they have to deal with a depth of 200 yards it will be very desirable to introduce some other kind of rope. I need only say a few words as to the ordinary forms in which apparatus is brought to bear when manual labour is used. The windlass seems a simple piece of machinery, but, nevertheless, it varies considerably in construction, and some are more ingeniously made than others. The principle is that of the simplest form of "wheel and axle," with the addition of a drum, which generally forms the barrel of the windlass. The drum or barrel is generally from 6 in. to 1 ft. in diameter. In a few instances, chiefly abroad, it may be considerably more. The average depth to which the windlass is worked in our metalliferous mines is not more than 10 fms., that being the extreme depth; but in Saxony double that depth is often worked by its means. In most cases at starting the windlass is placed over the shaft, but to prevent accidents from the rope breaking it is generally in collieries conducted over a pulley, and worked at the side. In some parts of France and in China it is arranged so as to form a sort of tread-wheel, turned by the weight of the men placed upon it.

SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE INSTITUTE OF MINING ENGINEERS.

The monthly meeting of the South Staffordshire and East Worcestershire Institute of Mining Engineers was held on Wednesday, at the Swan Hotel, Wolverhampton. Mr. North (the President) was in the chair, and he was supported by Mr. Henry Johnson (hon. sec.), and by a strong muster of members. Mr. Joseph Stokes, solicitor, of Dudley, and Mr. Brooke Ridgway Smith, mining engineer, Handsworth, were elected members of the Institute; and three gentlemen, mining engineers, of Newcastle-under-Lime, Burslem, and West Gorton respectively, were proposed. It was made known that in consequence of a contemplated visit of the members of the North of England Institute to Glasgow this summer the return visit by them to this district has been postponed until next year. The arrangements of the proposed Belgian excursion were modified. It is proposed that the members who go out shall leave London on Saturday, the 18th inst., by way of Harwich, for Antwerp, arriving at Antwerp early on Sunday morning; thence to Brussels, Waterloo, and the coal and iron districts of Mons, Charleroi, Namur, and Liége. It is intended to return by way of Paris, staying there on Sunday and Monday, the 26th and 27th, returning by way of Rouen, Dieppe, and Newhaven to London, arriving in the metropolis at about the 28th instant.

Mr. WALTER NESS, of Pelsall, read a paper "On Coal and its Products." The author said that coal might be briefly defined as mineralised organic matter, containing other earthy impurities in greater or less proportion. He then drew an analogy between peat and coal, from which he inferred that coal, like peat, was the result of decomposed organic matter, and argued that whether the formation of our coal fields was by the drifting of the plants of which it is composed into estuaries or lagoons, or whether they were originally peat mosses and forests, which lived and decayed on the spot where we now find their remains, or that both processes had been at work, it was evident that these vegetable growths did take place, and that they had become consolidated carbonished matter. This we now possessed in our different varieties of coal. After describing what must have been the nebulous condition of our planet before the appearance of organic growths germinated on its surface, Mr. Ness gave instances where the inflections and incurvations in the transition strata were subtended by horizontal bases of only one-third of their original length. In rising in the scale of formation, the unconformability of the strata became less. Hence, he argued strongly that this earth must at one time have been much greater in magnitude and less in density. Mr. Ness sketched the period of organic formation, and presently spoke of the consistent parts of coal. These he divided into three—volatile combustible matter, fixed carbon, and ash. In addition, the sulphur and water were worthy of notice. It ought, he reasoned, to be observed that in thus dividing it the value of the coke depended upon the smallness of the amount and the quality of the ash; and that the value of the coal altogether depended on the amount of volatile matter and fixed carbon put together. For gas-making volatile matter, and for heat-producing fixed carbon was essential. As these substances were compound bodies, an elementary analysis would show about 81 per cent. of carbon, about 5 per cent. of hydrogen, about 1⅙ per cent. of nitrogen, about 1⅙ per cent. of sulphur, about 6 per cent. of oxygen, and 5 per cent. of ash. These were the ultimate constituents, with the exception of the ash, which contained lime, magnesia, silica, iron, potash, alumina, &c. These elements unitedly constituted a variety of carbines of hydrogen which were decomposed by the application of heat, the compounds of carbon and hydrogen being the only valuable products.

After further enlarging as a chemist upon the illuminating properties of coal gas, and demonstrating his position by numerous experiments, in which his audience manifested the utmost interest, Mr. Ness gave a minute explanation of the manufacture of hydro-carbon, in the shape of spirit, burning oil, lubricating oil, and solid paraffin, at the same time showing samples of the cannel from which these were originally taken. Supposing that the coal contained 5 per cent. of hydrogen (which was the minimum), it would, after combustion, produce 40 per cent. of water. The carbon would produce over three and a half times its own weight in forming carbonic acid gas; so that, although these gases were to our view at first sight consumed, they produced over three times their own weight in the atmosphere. The balance of power was kept up by the vegetable creation absorbing the carbonic acid, and giving out oxygen in return. The very able paper was now concluded with some general observations pertinent to the occasion, and the lecturer resumed his seat amidst much applause.

The PRESIDENT intimated that the paper would be printed, and that it would come on for discussion at the next monthly meeting.

MANUFACTURE OF IRON—ON PUDDLING.

BY MR. RICHARD LESTER.*

From the earliest period of history iron-workers have existed. Tubal Cain is represented as the first instructor of the artificer in iron, but it has been worked upwards of 5000 years, and from time to time has had the greatest amount of skill bestowed upon it, but with all this the constituent elements of iron are still unknown. Yet sufficient knowledge is attained to make iron in such quantities that, for really useful purposes, it may be fairly ranked as the king of metals. To enlarge upon its adaptation would be to deal with every domestic article, tools, implements, weapons of defence and offence, the iron rod, the stately ship, the domestic sewing-machine, or the fisherman's hook. I will not further expatiate on the purposes to which iron is applied, but will at once proceed with the methods for its manufacture. The earliest mode of making iron handed down to us was by long and constant refining in a bath of melted oxide, until it would stand the compression of the hammer. Iron in the malleable form was the production of the early artificers, but we have no account of crude cast metal from the ancients. Of late years iron manufacture has made giant strides, the making of small quantities of malleable iron in the shallow hearth is superseded by colossal smelting-furnaces, where the ores are reduced to the metallic state, combined with many impurities. The cast has to be wrought or puddled before it is what is termed malleable iron.

In the years 1783 and 1784 Mr. Cort, of Gosport, invented certain methods of puddling, a process by which iron was really made in larger quantities, and his invention proved of great value, both in his time and to the present generation, so much so that he is styled the father of iron works. Mr. Cort's process was to puddle the crude iron in reverberatory-furnaces, and on sand bottoms. By your permission I will read Mr. Cort's process:—A common reverberatory-furnace, heated by coal, is charged with about 2¼ cwts. of half refined grey iron. In little more than half an hour the metal will be found to be nearly melted. At this period the flame is turned off, a little water is sprinkled over it, and a workman, by introducing an iron bar, or an instrument shaped like a hoe, through a hole in the side of the furnace, begins to stir the half-fluid mass, and divides it into small pieces. In the course of about 50 minutes from the commencement of the process the iron will have been reduced by constant stirring to the consistence of small gravel, and will be considerably cooled. The flame is again turned on, and the workman continues to stir the metal, and in three minutes time the whole mass becomes soft and semi-fluid, upon which the flame is again turned. The hottest part of the iron now begins to heave and swell, and emit a deep-blue lambent flame, which appearance is called fermentation; the heaving motion and accompanying flame soon spread over the whole, and the heat of the metal seems rather to be increased than diminished for the next quarter of an hour. After this period the temperature again falls, the blue flame is less vigorous, and in a little more than a quarter of an hour the metal is cooled to a dull red, and the jets of flame are rare and faint. During the whole of the process the stirring is continued, by which the iron is wrought to the consistence of sand; it also approaches nearer to the malleable state, and, in consequence, adheres less to the tool with which it is being worked. During the next half hour the flame is turned off and on several times, and a stronger fermentation takes place; the lambent flames also becomes of a clearer and lighter blue, the metal begins to clot and become much less fusible and more tenacious than at first. The fermention then by degrees subsides, the emission of blue flame nearly ceases, the iron is gathered into lumps and beated with a heavy-headed tool, finally the tool is withdrawn, and the aperture through which the iron was worked is closed, the flame again turned with full force for six or eight minutes, the pieces thus being brought to a high welding heat are withdrawn and shingled, &c.

Although the above process made good iron, it had a very good metal to start with, well cleared from many of the impurities which we have to contend with now. But much of the iron was spoiled because of the inability of the workmen to regulate the action of the iron on the bottom of the furnace, it being formed of sand, which drained off the oxide, which was also detrimental to puddling. The next improvement on Mr. Cort's process was the substitution of iron bottoms to the puddling-furnaces; and hereby the liquid bath of the oxide is retained by the iron, although the author of the iron bottom says it was the principal aim of his invention to work the iron in a bath of cinder; in fact, to boil it in a similar manner to the old process in charcoal fires. This part of the business was never carried out till Mr. Joseph Hall, of Bloomfield, Tipton, Staffordshire, brought it into practice. Mr. S. B. Rogers, who was the inventor of the iron bottom, never received much notice till his last years, when he received some gratuity from several of the Welsh ironmasters, but his work still stands, and to all appearance will be a lasting monument of his usefulness, although named "Mr. Iron Bottom."

You will here see that puddling has arrived at its present condition by slow stages, and improvements are being tried continually; but the elementary principle of puddling must be embodied in any scheme for the manufacture of iron if it is to be a success. This is the process I have to treat with to-day, and it is performed as follows:—The furnace is the reverberatory principle, the hearth at the bottom about 2 or 3 in. thick, and around, about 11 in. high, is coated with good oxides. When the furnace is hot enough to charge throw in your cinder or oxide which are found about your hammers or rolls; next charge the iron on the top of the cinder, the aperture of the furnace is closed, and the flame is put on. The charge is then melted in about 30 minutes, but during the melting the workman, with his rabble, breaks up the metal as it softens, and keeps it off the bottom. When the iron is sufficiently clear the damper is closed, which cools the furnace and checks the iron from becoming too hot, and surcharges the furnace with carbonic oxide, which prevents the iron from throwing off its carbon till the whole mass of metal begins to heave and rise; the damper is withdrawn, and the flame put on; the iron is in a state of evanescence or boiling, as it is termed, and the whole of the exertion of the workman is required here to keep the mass well open with the rabble, so that the carbon combined with the oxide may freely escape. The fire upon the grate must be kept solid, and the flame full in every part of the furnace, because any free air passing through the furnace attacks the iron as it begins to come into its mature state, as it is called.

It is at this stage of the process that each granule of iron takes up a fresh existence. The boiling of the iron must be forced as much as possible to its issue to keep the iron from clotting before the carbonic oxide is burnt out. It is also at this point that the cinder, with all its impurities, leaves the iron, hence it is necessary to keep the iron up, so that it shall be well wrought, and free from all deleterious substances. If the iron is not well boiled it falls into a crude or raw state to the bottom of the furnace, and if this be the case it is all but impossible to make wrought-iron of it afterwards. The iron being dropped, it requires the furnace still to be kept full of flame of a hot clear nature, but suited to the temperature that the iron will stand. The iron is now turned over from one side of the furnace to the other till it is sufficiently heated all through to adhere together, when it is formed into lumps, and taken to the hammer, and shingled and rolled into puddled bar. At this point it should be stated that although heat, especially a high heat, such as Bessemer attained during his decarburisation process, is of the highest value, yet it should be borne in mind that any separation which takes place after the boiling ceases is only undoing what is already accomplished—the cementation of particle with particle by the combination of oxides. My opinion is this, that a chemical action has taken place before the iron is dropped, and this is where welding commences. That should never be disturbed, for all cardon that is not required in the iron ought to be burnt out before the iron is settled down. The following is an analysis of the pig-iron previous to and after the Bessemer process:—The pig 1·012 bar, after 1·102; 2d. pig 1·090, after 1·960.

For the further guidance of those who take an interest in puddling, I have drawn up a few rules, which must be attended to when quality is required:—1. Thoroughly melt your charge.—2. Keep it in the melted state some little time.—3. Add carbon by lowering the damper.—4. Keep the fire well up while the iron is boiling, and work well every part of the charge, so as to bring about a thorough union of the iron and cinder.—5. Lower your damper proportionately to the temper of your iron, ball up, and carefully prevent the air or fire-oxygen from passing through the furnace, for it will burn the charge. Inattention to this is the great cause of bad iron. And I now beg, in conclusion, to draw your attention to the analyses and tests of samples of puddled bar made from No. 4 Cleveland pig-iron, which have been brought about by adhering to the above whilst puddling. The hardest of the samples stood a strain of 38 tons to the square inch. B, the softer, stood 38·8 to the squre inch. Now, as phosphorus is generally supposed to be the cause of the Cleveland pig not making a bar of ordinary strength, it was an anxious part of the business to know when it is taken out by the process of puddling, there being a suspicion that the mischief is done by the burning of the iron when it is dropped, rather than by the phosphorus. Besides, Dr. Percy says that the elimination of the phosphorus of iron is a problem of the highest practical importance, and that his opinion is that it comes away during the time the iron is sweating while being formed into lumps. It was necessary to try and find when it did escape. During the Bessemer process, which is similar to the boiling before mentioned in puddling, the analysis of the iron gives more phosphorus than the original pig-iron, and his iron was taken out before it had a chance of sweating. After-boiling shows only slight traces of phosphorus. Therefore, it must eliminate at some stage previous, which must be during the melting. It must escape as phosphoric acid among the cinder, which is oxide.

From the Darlington Iron Company, Albert-hill Iron Works, Darlington, to Mr. R. Lester, forge manager, &c., Messrs. Hopkins, Gilkes, and Co. (Limited):—"I got your sample bars to-day, but cannot think they are made from Cleveland iron only. I tested them very carefully at my leisure time, and find these extraordinary results to be from common stone. You will favour me with particulas, perhaps this next week. Test, &c., as below:—

No. 1 bar = ·88″ × ·80″ = ·7040″; broke at 25 tons; carried 24·5″; = 34·8 per square inch.

No. 2 bar = ·88″ × ·80″ = ·7040″; broke at 25 tons; carried 24·5″; = 34·8 per square inch.

Reduced in section at breaking part to ·82″ × ·74″ = ·6068″.

Yours truly, C. THOMPSON.

Sample marked "A soft"—phosphorus, slight trace. Sample marked "B soft"—phosphorus, trace. HERBT. CROSSLEY.

After the reading of the paper, a very interesting and animated discussion took place upon the different processes which iron underwent during puddling, in which Mr. Hopkins and Mr. Hill, of the Tees Iron Works; Mr. Thomas, of the Acklam Refinery; and Mr. Platts, the secretary, took a prominent part.—Mr. Hopkins thought it was very desirable to continue the experiments that Mr. Lester had made with pure Cleveland iron, and he hoped that other firms in the district would also make experiments in the same direction, with a view of carrying out the objects of the association—the practical discussion of such papers.—Mr. Thomas moved the adjournment of the discussion until the next meeting.—The Chairman proposed a vote of thanks to Mr. Lester for his interesting paper, and stated that on Saturday next the session would close by an excursion to the Eston Mines.

* Read at the Cleveland Iron Trade Foremen's Association.

INSTITUTION OF CIVIL ENGINEERS.

The annual Conversazione of the Institution of Civil Engineers, given by Mr. C. B. Vignoles, F.R.S., its President, took place at the Society's House, Great George-street, on Tuesday, and was very numerously attended. The models exhibited were of a particularly attractive character, and were examined with much interest. The Victoria Stone Works Company showed some excellent specimens of artificial stone; and the Patent Stone Working Company exhibited specimens of stone moulded by machinery, and a model of their new stone-cutting machine. A model of Carr's Disintegrator, which has been already described in the Journal, was shown by Mr. J. P. Richardson. An automatic boiler feeder, a self-oiling journal for locomotive axle-boxes, and an automatic weighing machine were amongst the models exhibited by Messrs. T. Brown and Co.; and there was also an excellent upright boiler-feeder, from Mr. J. C. R. Okes, Associate of Institution of Civil Engineers, which will be referred to hereafter. Amongst the specimens of metal were samples showing the process of iron and steel making, from the Bowling Iron Company. Mr. Parsons' specimens of white brass; a specimen of malleable cast-iron twisted cold, from Mr. W. H. Delano, Associate of Institution of Civil Engineers. Mr. H. Chapman's samples of metal work obtained from a tube by direct hydraulic pressure without an internal die, and Mr. W. R. Roebuck's specimens of compression castings excited much interest. Models of a buddle for separating ores, by Mr. J. H. Williams; of an exhausting machine for ventilating mines, by Mr. J. Cooke; and an improved magneto-electric mine exploder, were also exhibited, and were considered to be of great practical value. The agreeable character of the conversazione was much increased by the pains which the several exhibitors took to explain the objects and peculiar merits of their inventions—an explanation which at many similar gatherings it is almost impossible to obtain. The extent of the exhibition may be judged of when it is stated that the catalogue contained 157 titles in the portion devoted to engineering models and instruments, whilst the works of art division was still larger; and it may safely be affirmed that all who were present had full opportunity of acquiring a vast amount of useful information, as well as much enjoyment.

TUNNELLING MACHINERY.—The specimens exhibited by the Stone Working and Tunnelling Machinery Company were of as good workmanship as could be desired, and it appears that with one of their patent moulding 8000 ft. run of the string course of new St. Thomas's Hospital has been executed. Quarry owners can contract with the company for the loan or gradual purchase of machines for tunnelling, cutting rock out of the quarry, or executing orders for simple running patterns, or squared blocks, &c., on convenient ground near railway stations or canals.

KNOWLES'S WROUGHT-IRON PERMANENT WAY.—The object of this system of way, the model of which was exhibited by Mr. BELLINGHAM, of Bush-lane, is to procure so good a road that the wear and tear of the tyres and axle-boxes, and breakage of engine-springs, shall be reduced to the minimum. The usual timber sleeper is replaced by a rolled and curved plate of wrought-iron, grooved for the reception of wrought-iron jaws, which hold the rail, instead of the present cast-iron chairs. Iron rods, passing from one rail to the other, maintain the gauge of the road, and nuts on the ends of the rods, screwed up against the jaws, lock the rails in their position. Where one rail meets the other longitudinally, the ends are fished by an extra length of jaw, making the joint perfectly sound, but not too harsh. The fibres of the wrought metal in the sleeper, jaws, and rail being all in the same direction, the parts work well together when subject to the action of passing loads, and the rail being suspended in the jaws, the motion is easy, and the hammering and jarring common to the present roads are done away with. Whilst affording greater comfort to the passengers, it is also less destructive to the rolling-stock than any of the present systems. The few parts and its great simplicity are additional advantagess, and the form of the sleeper renders the operation of packing easy. This road, it is believed, will meet the evidently increasing desire to obtain a really permanent way in place of one constructed with perishable material, which must soon be discarded on our principal home lines, where economy can only be attained in conjunction with thorough efficiency. Although the first cost of a road upon this system may be somewhat higher than others, it is claimed that it is by far the cheapest in the long run. By careful and honest calculation it is found that a timber sleeper road for the same weight of rail might be laid in this country for about 120*l.* less per mile. This saving in the first instance is most insignificant when the duration of the wrought-iron road is taken into account. With regard to use in India and other countries, where wood quickly perishes, its cost, including freight, is about the same as cast-iron pot sleepers, while the great saving in carriage up country, and the total absence of the loss caused by breakage in transit, which is very great with cast-iron pots, renders it much more economical.

SAFETY LOCKING SWITCH.—An improved safety locking switch, combined with locking signal apparatus for railways, was exhibited by Mr. JOHN BRUNTON, M. Inst. C.E., of Great George-street. The motion of the cams which move the points brings up a block or wedge, which, when the motion of the lever is completed, effectually fixes the switch or point in its position; but before such movement of the points-lever can be made the pointsman must move the distance signal to danger, and block the line; and, further, the movement of the points-lever must be complete, and the switches locked or wedged before he can move the other signal-lever, and show the "all right" signal to the train advancing to run into the branch line or siding. It is claimed that this mode of working the points and signal apparatus ensures that the switch or point, when either completely open or closed, shall be so fixed in its position that the vibration of the passing trains, even at high velocities, shall have no tendency or power to alter such position; that the signals indicating the position of the points shall be so arranged that it is out of the power of the pointsman to make any error, such as showing "main line clear" whilst his points are open to the siding or branch, and *vice versa*; that the arrangement of the signalling and points-locking apparatus should be such that each of the three movements necessary for the whole operation—blocking the main line, moving the points, and opening the siding or branch, or *vice versa*—must be complete before the next movement can be made, and that the order or rotation of these movements cannot be interfered with by any carelessness on the part of the pointsman. It is maintained that if the distance-signals of station sidings or branch lines were thus intimately connected with the points on the main line, and by their arrangement unerringly showed the danger signal to approaching trains until the points were fixed in their proper position, many of the late lamentable accidents entailing the loss of life and property would have been averted. It is further submitted that with such an arrangement as is thus proposed the danger of facing points is reduced to a minimum, and their larger application, now so studiously avoided, would be followed by increased facilities for the shunting of goods trains, and by it the saving of much time and risk would be secured.

TWIN PASSENGER STEAMER.—In connection with the proposition which has recently been made for carrying railway trams bodily across the Channel to France, the invention of Mr. ANGELO J. SEDLEY, of Conduit-street, was particularly interesting. The dimensions represented are—length between perpendiculars, 432 ft.; extreme breadth over paddle-boxes, 97 ft. 6 in.; depth underside of pontoon deck amidships, 22 ft. 6 in. There are eight cabins on main deck, each 50 ft. long by 22 ft. 6 in. wide, and 15 ft. high, with arrangements for separate sleeping cabins above, reached by internal staircases, and there is a promenade or fair-weather deck 300 ft. long and 60 ft. wide. The railway alley is 26 feet wide and 300 ft. long, and has three lines of rails. Mr. Sedley uses 40-ft. paddle-wheels, 16-ft. breast, driven by 500-horse engines, with dry steam 250 lbs. on the inch, using distilled water, and working on Perkins's system up to 3500-horse power, on a consumption of 1½ lb. of coal per indicated horse-power. The steering is effected from the bridge by hydraulic or steam-power. The total weight, everything on board, is calculated at 1600 tons; he anticipates a speed of 25 to 30 miles an hour. The inventor regards his vessel as the ocean steamship of the future, and describes her as a twin boat with deck houses built upon her turtle-shaped back or deck, which will be well protected fore and aft from seas that might break over her, with bulwarks also of great height, sufficiently strong to resist the impact of a monster wave; built in compartments throughout, she might be made practically unsinkable, and calculated from the form of the hull or pontoons to rise easily over broken water. Drawing but little water, and upheaved on to the surface by the section of the hull, propelled by paddle-wheels, one on each side, and one astern, with proper engine-power, "she would walk the water like a thing of life," at a speed unknown and unheard of in the present day. In this commodious vessel, of from 12,000 to 20,000 tons, would be found a floating palace, decorated with some regard to the laws of good taste which will at that period obtain. And in this palace will be found all the agrêmens and delights of fashionable and domestic life ashore, with the bright inspirating and exhilirating influence of the sea, when sea-sickness is no longer to be dreaded. In the vast interior will be found a range of shops for all those various fancies which the fair sex mostly affect; a newspaper and post-office, spacious promenades, open and covered, a theatre and ball-room, a library and smoking-room, baths hot and cold, and lastly a drawing-room, luxuriously fitted, surrounded by private apartments, and containing each a sitting-room, with bed-rooms above, which are approached by interior staircases, all nicely arranged with a view to comfort. This ship of the future is to be driven by paddle-wheels, one on each side and one astern, cycloidal and segmental in form, with the best then known system of feathering, so as to give the maximum of effect with the minimum of power. The engines to drive these paddle-wheels, and also to steer the boat, shall be 450-horse power, to indicate 5000 actual, will be reciprocating or rotary (rotary preferred), made of the best materials, and highest finish, so far as regards the working detals; the whole construction to exhibit the least number of moving parts, and the utmost practical and mathematical accuracy possible. This engine shall be actuated by an inexplosible generator, making clean dry steam, conveyed into it 200 lbs. on the square inch, working expansively through two grades. The generator will be heated by liquid fuel, made either from the substances now in use for that purpose, or from some new untried material, largely combined with salt water, and manufactured as required. And, lastly, the vessel would be lighted from stem to stern by refined gas, forming at night a grand illumination. There would be also two or more centrifugal pumps, each discharging at least 10,000 gallons a minute, ready at a moment's notice to put out a fire, stop a leak, to steer the vessel, or assist in propulsion, in case of a break-down of the engines.

GUNPOWDER SUPERSEDED.—An improved machine, the invention of Mr. J. GRAFTON JONES, for breaking down coal, superseding the use of gunpowder and hand-driven wedges, was exhibited. The principle of these instruments, and their mode of application, was fully explained in the Journal. This machine, which is of power sufficient to break down or lift the strongest coal (after it has been holed), is now so much improved that it can be inserted into a hole only 2¼ in. in diameter, and with it one man exerts a force equal to a pressure of 200 tons, while its weight complete, including the wedge or pressing blocks, does not exceed 40 lbs. This truly wonderful result has been arrived at by repeated improvements in construction, which consist in substituting for the ordinary force-pump (the valves of which cannot be made to sustain the great pressure required) a screw pump, and screw conical steel plugs in place of the usual valves; these plugs have been proved to hold water-tight against a pressure of more than 100 tons to the square inch. The introduction of this screw pump and of the plug valves has reduced the weight to one-fourth of what was necessary to obtain the same power with the best plunger pumps. Mr. Grafton Jones has constructed larger machines than the one exhibited (the weight of which is less than 1 cwt.), with which coal has been pushed out of the solid, thus in many seams obviating to a great extent the necessity of loading the coal. Mr. Grafton Jones may be congratulated on having at last achieved a success. The holes into which the machines are inserted can be put in with the improved drill in from five to fifteen minutes, according to the size and nature of the mineral.

DIVING APPARATUS.—The efficiency of Mr. SIEBE'S diving apparatus has long been acknowledged, and at the conversazione on Tuesday an opportunity was afforded for examining the several parts of the apparatus. In some recent experiments at Chatham Dockyard air was supplied to both the divers by means of the one pump, and after walking a considerable distance, and remaining under water some time, the divers returned to the surface, both stating that they were furnished with abundance of air, while neither suffered the slightest inconvenience. Not the least of the advantages of Mr. Siebe's invention is the fitting of the diving apparatus with a self-acting pressure gauge, which registers the pressure in pounds, while a submarine lamp can also be applied to the pump, by which means the diver can be assisted by a steady light when employed in exploring the interior of a vessel, or descended to any depth to which the light of day does not penetrate. The Admiralty diver subsequently descended to the great depth of 108 feet with the two cylinders of the air-pump connected, followed to the same depth by Sergeant Baker, of the Royal Engineers, who made his first descent, when, even at the depth and under the conditions stated, not the least inconvenience was experienced by either of the divers, who remained down for some time, the valves, gauge, register, and other parts of the apparatus all working most satisfactorily. The officers and men at the Royal Engineer establishment will commence their summer course of practice in diving operations with Mr. Siebe's apparatus and the improved air-pump.

THE NEW TIMBER SLEEPER PERMANENT-WAY.—The models of Mr. FEATHERSTONE GRIFFIN'S economic permanent-way are certainly entitled to be classed amongst the most attractive exhibits connected with railway materials. Mr. Griffin claims that the advantages of his new system over that of a first-class transverse timber road are based upon well-known scientific laws. Instead of wasting the most vital principles of a good road—the largest proportion of rail and sleeper bearing surface, and having the fastenings placed as they are now, subject to tremendous strains and leverage, the injurous effects of which, natural and artificial causes, are ever tending to augment, by decaying and loosening them—they are by Mr. Griffin's system entirely economised, and the maximum value of each separate part is obtained, and, as far as it is possible, preserved; moreover, they so much more closely unite in their application that with considerable less weight of material far greater strength and security are given to the whole structure; and, at the same time, the injurious effects of the natural and artificial causes of failure are reduced to a minimum. The rail, instead of having but a few inches of bearing upon each sleeper, has such a large amount of support, is so much more firmly held, and its tendency to turn, or buckle, is so completely prevented by its enclosed position, and the immense force of the grip upon it, that, whilst having far more available wearing surface, at least 25 per cent. less weight is necessary, and its maximum strength is obtained by a minimum increase of weight; moreover, with more or less advantage, this system can be adapted to almost any form of rail, though it would be difficult to devise one more troublesome and expensive to keep in proper position than the double-headed rail ordinarily used in this country, it having about the same aptitude as an egg to stand in the position it should naturally assume. It is considered that for steel rails this system is especially valuable, from the form of the head allowing (from the great support given) a much larger amount of wear upon it, and from the impossibility of breakage, or derangement of the fastenings, a line would require fully 50 per cent. less cost of maintenance in-

spection. The preparation of the timber is effected in the most inexpensive manner, being simply squared and bored by machines in every-day use. When delivered upon the ground the rails have only to be dropped in place, when the road is ready for traffic in one-half the time now occupied. It is, in fact, shop labour, with every facility and convenience against open-air labour (exposed to every extreme of weather), without either the one or the other. The rail can, by no possibility, come in contact with any other substance than wood, and being completely enclosed and supported by wood the vibration is almost entirely absorbed by it; moreover, the immense power of the bolts can be made again and again available by drawing them back, and putting a compensating strip of packing under the head of the rails. The immense economy in the weight and form of rail is always proportionate, whether the system be adapted to the heaviest or lightest traffic, and the packing upon which it rests (if the system with packing is preferred) takes a bearing of from 4 to 6 in. wide upon the sleeper, and has been most conclusively proved to be almost indestructible, when protected by the overhanging lips of the head of the rail. Taking Mr. Griffin's system as a whole, it appears to be worthy of favourable consideration, especially in new countries, where timber is plentiful and cheap, and metal has to be taken from England. The rails, weight for weight, will probably prove more durable than those of any other section yet proposed.

ARTICULATED LOCOMOTIVE.—The model of Messrs. DREDGE and STEIN'S articulated locomotive for mountain railways showed a particularly ingenious mechanical arrangement, intended to meet this difficulty, by supplying a means of coupling a large number of wheels together in such a way that perfect flexibility is preserved in the machine, so that it can adapt itself to any curve, and all irregularities of the road, the coupling being effected in such a way that the resistance to the working of the engine will no longer increase in a multiplying ratio, but will be simply proportional to the number of wheels coupled. To effect this Messrs. Dredge and Stein propose to couple the axles of separate bogies or trucks by means of cranks, so arranged as to form a joint, which is perfectly universal within certain limits, the wheels of each separate truck being coupled together by cranks set at right angles to each other in the usual way. The advantages claimed for the invention are—diminution in the friction from the wheels being coupled in groups, and the consequent facility of coupling a much larger number of wheels together than has hitherto been practicable; perfect flexibility of the driving machinery, which admits of a long and powerful engine on sharp curves, and reduces the curve resistances to a minimum; the possibility, as a consequence of the above, of having a much more powerful engine either for heavy traffic or easy gradients, or for steep lines than is at present practicable; utilising, in certain cases, part at least of the paying load for the purpose of obtaining adhesion in mountain lines; and saving in the construction of the permanent way in consequence of the distribution of the weight, the less necessity for a perfectly true road, and the diminished lateral strains to which it will be subjected.

FINE CASTINGS.—Some exquisite castings produced by compression and in vacuo, were exhibited by Mr. W. R. ROEBUCK, of Victoria-street. It is claimed and the articles exhibited certainly fully supported the claim, that the highest class works of art, such as bronzes, bas-reliefs, engraved or repoussé work, can be repeated in any metal with the most perfect accuracy by unskilled hands, indeed so exact is the copy that the most minute type or the finest woodcuts can be cast, and the casting printed from, producing impressions as sharp and clean as if they were printed from the original type or wood block. The iron castings are as smooth and as perfectly finished as if they had been lathed or planed. The advantages secured are the greatest possible density, homogeneity, and freedom from blow-holes of the metal cast, and this is secured by the application of a very moderate amount of pressure. The most perfect, sharp, clean, and well-defined fac-similes of any desired pattern, whether plain, simple, elaborately chased, engraved, or otherwise finished. The production generally by machinery and unskilled labour, and with the greatest rapidity and economy, not only plain and ordinary castings of any hard or refractory metal, but also the production of the finest and most elaborate casts in a perfectly finished state, and which have heretofore required to be finished by artistic hands at a great cost.

STEAM-MOVED PISTON VALVES.—Messrs. WILSON and Co., of Wandsworth-road, exhibited a working sectional model of Baumann's patent steam-pump, in which by means of sections or segments of the piston and piston-valves, the whole arrangement of the valves, and the distribution of the steam could be clearly seen. It is a valve arrangement of the most ingenious description, and entirely dispenses with all tappets, springs, and other striking gear. It is remarkably steady and noiseless in its movements, and friction is reduced to a minimum; the model is easily worked by a common portable bellows, while in practice the pumps move with 4 lbs. of steam. The extreme simplicity of its moving parts renders it very economic, although they are of the most solid and durable description, and readily accessible. Besides being applicable for pumping machinery, this valve motion is no doubt equally suitable in every case where reciprocating motion is required, and would be especially valuable for coal-cutting and rock-drilling machinery.

HAND-POWER SHEARING MACHINE.—The machine constructed by Messrs. REED and BOWEN, of Boston, U.S., and exhibited by Messrs. TOWLE and HARDING, of Newgate-street, is a combined punch, shearer, and upsetter; its power is enormous, it being estimated that the application of 100-lbs. force on the hand lever gives upwards of 52,000 lbs. on the shears and 72,000 lbs. on the punch, yet only four levers are used, and the arrangement is not at all complicated. The machine is one which when known will become as great a favourite for the purpose for which it is intended as Blake's stone-breaker, another American invention, has become amongst miners. The machine weighs but 350 lbs., and cost less than 20*l.*, yet with it one can cut cold iron 2¼ by ½, or 4 by ⅜, in two, and leave a nice smooth face, and the punch makes a clean, smooth hole, and is said never to split the iron.

UPRIGHT BOILER FEEDER.—In noticing last year's conversazione reference was made to Messrs. HAYWARD TYLER and Co.'s universal steam-pump, and it was mentioned that the engine which worked it was of extreme simplicity, having but two moving parts—a piston with a cylindrical steam slide-valve within it, actuated directly by the steam, by the main piston passing over certain ports or openings in the steam-cylinder, the valve moving in the opposite direction to that of the piston. No tappits, springs, or other contrivance are required to produce the reciprocating motion. The engine has neither fly-wheel, crank-shaft, bearings, eccentrics, connecting-rod, pins, joints, tappits, springs, nor small valves to regulate the action of the steam. It can be worked at an extremely slow rate of speed, below 10 strokes per minute, or at a high rate, above 300 per minute, by simply regulating the admission of steam to the cylinder. There are no "dead points," as in a rotating-engine, steam being always "on" at one side or other of the piston, so that the engine will start at any point whatever upon admitting the steam. The same exhibitor—Mr. J. C. R. OKES, Assoc. I.C.E.—this year showed the same invention in the form of an upright boiler feeder, for which purpose it appears especially applicable. The apparatus is not liable to get out of order, and is inexpensive, a boiler feeder for a 15-horse engine costing but 18*l.*, and one for a 50-horse engine but 28*l.* The whole apparatus can be taken apart, and put together again in a few minutes without disturbing any of the connecting pipes.

UNIFORM MOTION WITHOUT FLY-WHEELS.—The advantages of enabling single engines to start, reverse, or drive machinery with the facility and regularity otherwise obtainable only with double engines is so obvious that the working model and drawings exhibited by Messrs. MACGEORGE and RIGG, of Chester, were of considerable interest. The turning gear consists of a small supplemental oscillating cylinder, which serves as a reservoir of pressure, absorbing the excess during the middle of the stroke, and giving it back again towards the ends. By the application of the invention a very uniform motion can, it is claimed, be obtained without fly-wheels, and thorough command of the engine can be secured at all speeds without the necessity of the large extra first cost of double engines. For mining and colliery purposes the arrangement may prove of great value, and may be the means of preventing a considerable proportion of the accidents which now occur annually from overwinding with single engines.

BEAMS, COLUMNS, AND ARCHES.

The necessity of giving theory quite a secondary place as compared with practice is daily becoming more generally recognised, even by those who not long ago exerted themselves most strenuously to create the fear that we were being excelled by continental nations, and that the cause of the alleged superiority was the greater attention given in France and Germany to the technical education of the industrial classes; the publication, therefore, of Mr. BAKER'S work, "On the Strength of Beams, Columns, and Arches,"* will give satisfaction to a very large number of engineering students—to whom the nature of the book will be sufficiently apparent when it is stated that the author has endeavoured in all instances to assimilate the process of investigation to the ordinary routine of the drawing office; in other words, he has preferred compasses to equations, and scales to logarithms, whenever the selection was optional. He contends, and with much truth, that in engineering lengthy infinitesimal calculations not only involve an unjustifiable waste of time, but have the great contingent disadvantage of checking the growth of sound judgment in the engineer by giving a fictitious appearance of accuracy to results which are not susceptible of exact deduction. The application of mathematics to engineering problems has, he continues, attained a highly developed stage; indeed, those conversant with the technical literature of France and Germany will at once concede that it has far outstripped our present knowledge concerning the strength of materials. We have ample stores of experiments to enable us as practical men to give safe and economical proportions to our structures, but we have not such a class of experimental data as would enable any mathematician to advance general theories capable of universal application. The practical result of this condition is that the laborious investigations of the ablest mathematicians commonly resolve themselves into minutely exact formulae, based upon purely provisional and undemonstrated hypotheses. We are professedly furnished, as it were, with the precise position of the tangent points in our curves and changes in our gradients at a time when we have nothing but the roughest possible survey of the route of our line.

In treating of the strength of steel rails and analogous beams, which occupies the first part of the book, he maintains that nothing is so good as the simple application of a gradually increasing bending stress to the centre of a piece of rail, resting upon bearings 5 ft. apart, the deflection and set being noted after each successive increment of stress. The rough and ready test of a falling weight is inexpensive, and it answered well enough in its day, but for comparative results he considers it a very fallacious guide. In the investigation of problems relating to the transverse strength of beams, the commonly accepted law *ut tensio sic vis* is a sufficient approximation to the truth in instances where the web portion is small in comparison with the gross section, but when, as in a solid square or rectangular bar, it is of equal section per unit of depth with the flange portions, or still more when, as in a round bar, or in a square bar strained in the direction of a diagonal, the web portion is even more excessive, that simple law gives perfectly ridiculous results. Starting with these views, Mr. Baker proceeds to ascertain some reliable method of computing the probable strength of cast-iron, wrought-iron, or steel beams of any given form of cross section, and with this object he first derives certain data from the analysis of a large series of experiments on the transverse strength of simple bars. The variance in the proportional strengths of different forms of bars suggested the existence of a certain relationship between the apparent tensile resistance of the extreme fibres in the beam and the form of cross section, a provisional hypothesis was consequently made, and the transverse strengths of more or less complicated sections of beams were computed. In the results thus deduced, compared with those derived from direct experiment, no essential difference was in any instance observable; the practical accuracy of the hypothesis upon which the calculations were based may, therefore, be considered satisfactorily demonstrated. The aim of the investigation has been to prove that sufficient data being advanced to enable the quality of the metal to be determined, the strength of any form of beam might be computed to as great a degree of accuracy as that of any simple bar subject to a pulling stress only; the various experiments being selected with the view of making it as far as possible self-evident that bending stresses and direct stresses are in all instances convertible terms.

In discussing the stiffness of steel rails and other analogous beams, Mr. Baker observes that a kind of fatality seems to attach to all simple and fascinating generalisations, since, like Kepler's laws, they almost always turn out upon more careful investigation to be only broadly true. If the extension and compression of fibres under strains excited by transverse stresses were the same as it is under direct strains, the deflection of a cast-iron bar under a given transverse stress might easily be computed. It has been found, however, that there are many anomalies in the theory of transverse strength, and the same may be expected to obtain in that of deflection. The first question, he says, suggesting itself is—Will the deflection be that due to the actual or to the apparent strain on the fibres, or will it be governed by some other condition conjointly with one of those? This question can only be settled by a series of experiments arranged with that view, but those carried out by Mr. Barlow for another purpose throw a little light upon the subject. A beam, 7 ft. 4 in., 6 in. deep, and 2 in. thick, was subjected to a stress of 5786 lbs., applied at its centre, when the extension of the outer fibres measured by the micrometer was ascertained to be one 1792nd of the length. Now, the apparent strain on the fibres under that load would be 10,608 lbs. per square inch, and a direct strain of that amount extends cast-iron one 1056th of the length, or nearly double that exhibited by the beam. Other experiments gave similar results. With reference to the strength and stiffness of permanent way, Mr. Baker remarks that it is instructive to observe how closely the relative strength of permanent way arrived at by a strictly tentative process approximates to that of other engineering structures. There appears to be some peculiar virtue in a strain of 5 tons per square inch on wrought-iron since whether the structure be a Britannia Bridge, a steam-boiler, or a simple rail, the force the metal has to sustain never varies much from that degree of intensity. This fact should not be forgotten when considerations of economy are prompting the engineer to adopt too light a section of rail; for it is evident that this could not be done without rendering the metal liable to a strain greater than that which practical experence of a varied nature distinctly points out as the useful limits of its resistance.

The succeeding part is devoted to the consideration of the strength of columns, and the fifth part to arched ribs, and there is then some admirable remarks on the proper depth for girders. The influence of the weight of the web is the most important element in determining the proper depth for a girder, because while all the disturbing influences affecting the flanges also affect the web, there is in addition another element introduced—the limiting thickness below which the plates may not be reduced. As far as the web is concerned, there would obviously be a practical advantage in making the depth of a girder small in proportion to the span and load. Thus, in shallow girders heavily loaded the gross average thickness varies from twice the net for short spans to two and a half for long spans, but as a small depth is a disadvantage to the flanges, the determination of the depth at which the joint weights of the flanges and web will be a minimum is the problem to be solved.

Mr. Baker's work cannot be read through without the reader becoming convinced that the author is a thorough master of the subject on which he writes, and well able to convey the knowledge he possesses to others; he has produced a book which, if less elaborate and technical than those of Rankine or other leading mathematical writers, is not less useful to the practical man.

* "On the Strength of Beams, Columns, and Arches: considered with a view to deriving methods of ascertaining the practical strength of any given section of beam, column, or arch in cast-iron, wrought-iron, or steel." By B. BAKER, Assoc. Inst. C.E. London: E. and F. N. Spon, Charing Cross.

FOREIGN MINING AND METALLURGY.

There has been no falling off at present in the prosperity of the Belgian coal trade. This prosperity has been attested in a striking manner by the higher rates obtained at the last adjudication for supplying the requirements of the Belgian State Railways. This adjudication took place recently, and in the interval which has since elapsed the extraordinary firmness in prices has been maintained. As regards coke, also, it may be observed that the production has been engaged for some time in advance, and that a rise in prices is anticipated. Unwashed coke makes 16s. 10d. to 17s. 1d. per ton, and washed coke 19s. 2d. to 1*l.* per ton. Complaints are still heard in some quarters as to the insufficiency of the plant placed by some of the Belgian railway companies at the disposal of coalowners; it is difficult, however, of course, to please everyone. The exports of coal from Belgium in the first three months of the last three years attained the following importance:—

	1870.	1869.	1868.
Russia ....Tons	—	350	—
Zollverein	3,783	4,062	2,760
Low Countries	28,264	23,259	21,570
France	853,426	826,176	790,047
Other destinations	711	61	804
Total	886,184	853,908	815,181

As regards the exports of coke from Belgium during the same periods, the totals stand thus:—

	1870.	1869.	1868.
Zollverein ....Tons	65,442	55,045	39,442
Low Countries	193	81	52
France	113,408	91,887	87,418
Other destinations	—	389	—
Total	179,043	147,402	126,912

The Belgian iron trade still presents a favourable appearance; work is generally abundant, but especially in the rolling-mills producing rails. There is, however, nothing very particular to record in connection with the trade, besides the re-adjudication which has taken place at Brussels of a contract for cast-steel Bessemer-Vignoles rails for the Belgian State Railways. The re-adjudication comprised two lots of 975 tons each of rails, with fish-plates, bolts, &c. The adjudication should have taken place April 13, but it was postponed, no tender having been sent in in consequence of what were considered the exaggerated conditions presented by the *cahier des charges*. This *cahier des charges* was revised to meet the views of forgemasters, and the re-adjudication was attended with the annexed results:—MM. Adhémar, Le Roy, and Co. tendered for each of the two lots at 12*l.* 12s. 8d. per ton, with delivery at Antwerp; and Messrs. Tiedern, Nordenfeld, and Co., a London firm, also tendered for the two lots at 12*l.* 5s. 3d. per ton, with delivery at Antwerp. The price of the two tenders differed, then, to the extent of 7s. 5d. per ton. The result is all the more remarkable since hitherto in almost all adjudications, even when tenders have been invited for products manufactured after English systems, English firms have stipulated for sensibly higher prices than those required by Belgian houses. The imports of steel, iron minerals, and worked iron into Belgium during the first quarter of this year present a sensible advance upon those of the corresponding quarters of 1869 and 1868. The exports of rails from Belgium during the first quarter of this year amounted to 22,595 tons, against 17,916 tons in the corresponding period of 1869, and 14,806 tons in the corresponding period of 1868. Plates were exported to the extent of 5061 tons, against 5082 tons in the corresponding period of 1869, and 3091 tons in the corresponding period of 1868.

The state of the French coal basins continues favourable. In the Nord and the Pas-de-Calais the stock of disposeable merchants' coal is nearly *nil;* the supply of other descriptions is more abundant. Prices of all descriptions maintain great firmness, and it may even be said that an early advance is anticipated. Deliveries by water and railway proceed very well. The Paris coal market begins to regain a little animation; negociations on the subject of renewals of contracts are again being entered upon, and some works have accepted the advance in prices required by the coal workers. There has been an improvement this week in the state of the iron trade in the Champagne group; orders are now following a regular course, and great firmness prevails in all articles; some have even advanced. Refining pig begins to be sought after by the more remote rolling mills of the group; excellent pig is now manufactured with the rich minerals of the Blaise, worked with good coke and vegetable combustible. The quality of the pig obtained is so good that some forges which for ten years past have not supplied their requirements in the Champagne group have just concluded heavy contracts. Some producers conclude, from this fact, that the moment is come to construct blast-furnaces of large dimensions. Charcoal-made pig continues scarce, and it is not parted with for less than 5*l.* per ton. Iron remains in good demand, at the following rates:—Rolled coke-made iron, 8*l.* to 8*l.* 4s.; mixed ditto, first quality, 8*l.* 16s. to 9*l.*; charcoal-made pig, first quality, 9*l.* 8s. to 9*l.* 12s.; ditto second quality, 9*l.* to 9*l.* 8s. per ton. Hammered iron is quoted at 9*l.* 16s. to 10*l.* for bars, and 10*l.* 4s. per ton for axles. In the Moselle the aspect of affairs continues favourable; production is being carried on with vigour, and orders become more numerous from day to day. The foundries of the Meurthe are pretty well off for work. The imports of pig and castings into France in the first three months of this year compare as follows with the imports in the corresponding period of 1869:—

	1870.	1869.
Imported free of duty ....Tons	33,426	34,568
„ for shipbuilding	1,349	461
„ with payment of duty	482	1,016
Total	35,257	36,045

As regards iron and plates, the totals stand thus:—

	1870.	1869.
Imported free of duty ....Tons	16,104	9,636
„ for shipbuilding	2,198	2,283
„ with payment of duty	566	276
Total	18,868	12,195

The Paris iron market has maintained itself well of late. The Naval and Railway Blast Furnaces, Forges, and Steel Works Company commenced the payment on Tuesday of the balance of the dividend for 1868-9, or 6s. per share. The Bethune Mines Company has been paying during the last few days its second dividend coupon for 1869, or 10s. per share.

The continental copper markets have continued quiet, and it is probable that this state of affairs will continue some time for several reasons. At Paris, Chilian in bars is quoted at 69*l.*; Chilian in ingots, 73*l.*; and Corocoro minerals, 72*l.* per ton. At Marseilles, Spanish is quoted at 68*l.*; and refined Chilian and Peruvian mineral, 76*l.* per ton. The German markets have been generally quiet; the article has not given rise to many transactions, but prices are tolerably well sustained. The French tin markets present little change, but in Germany there has been a slight revival. Little change in lead or zinc.

FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho, April 29:—Morro Velho produce, second division of April, 12 days, 2297 oits.; yield, 1·714 oits. per ton. New shafts sunk—A, from April 11 to 30, 3 fms.; B, from April 11 to 30, 5 fms. 1 foot.

DON PEDRO.—Mr. Symons, April 29: Produce to date, 6727 oits.; estimate for the month, 8727 oits. The shallow workings and reserves are poor but average general work. A little box has been taken from canoa in the under-lie lode; the supply from this rich section is becoming daily less, owing to the increase of water, and until Vivian's shaft is down sufficiently deep so as to drive under and drain it; we cannot hope to work it with advantage. The necessity of prosecuting sinking Vivian's shaft is daily becoming more and more evident. The line in No. 6 is poor, and no rich work as yet has been met with in the lodes at Alice's west, they are, however, most promising. The ground in Treloar's and middle adit is favourable; we shall strive hard to complete Treloar's by the end of the year. Several carpenters are getting ready the wheel for the horse-engine.

ANGLO BRAZILIAN.—The health of the establishment is good, force improving, and the appearance of the mine presents little or no change to comment on, the works at the different sections are being pushed on with vigour.

TAQUARIL.—Mr. T. S. Treloar, April 28: The pumping-engine was successfully put to work yesterday, and I have great pleasure in stating that it is working in an extremely satisfactory manner, and its duty realising the most sanguine expectations. Among the spectators the former chief proprietor of the property was present, and manifested a lively interest in the proceedings. The perfect completion of the machinery will probably take two or three months more, but the work remaining to be done can be accomplished while the rods are in motion. In the level northward for explorations (named Martin's cross-cut) the lode has not yet been met with, but appearance of end at present is highly promising for gold.

GENERAL BRAZILIAN.—T. Treloar, April 28: General Operations: Most of the hands away for Easter are back, but while away their absence told against our general operations; I hear of more force coming here shortly. At St. Anna the ground in the old and shallow adits is still soft wet flookan, and that in the latter is so troublesome as to require six Englishmen, or two in a corps. The deep adit has been under suspension. The ground here too is flookan, and as the work is yet an open cutting, and weather showery, it was deemed advisable to suspend it till rains have quite ceased. At Itabira the shallow adit is still progressing satisfactorily; the ground is now jacotinga. It is dry, but so soft as to require timber. The middle adit is still under suspension. At Davey's shaft a few fathoms have been opened in different directions on the jacotinga, which showed gold, as referred to in my report for March, but hitherto no shoot of gold has been found; until the cross-cut is communicated to the shaft the operations here will be limited. At Itabira explorations were commenced yesterday with a few hands, and from what I saw I believe produce will be obtained from here this year. The roof for the new store is now being put on; on the new road little has been done, the timber coming in plentifully, twenty more working cattle purchased; surveyor about map of estate and mine, captain levelling for water course; health of the establishment fair, but two English miners on the sick list.

ROSSA GRANDE (Gold).—Mr. Ernest Hilcke, April 28: In the mine little or nothing new has occurred since my last. The attendance of force is slightly increasing, and works have been prosecuted with vigour. At Mina de Serra the size of the lode continues small at all points of operation, with the exception of the shaft; the lode here maintains its highly encouraging features, and I am much pleased to state that the quality of the stone throughout the mine is equally good as that of previous month. At the Cachoeira and Gongo Mines, no changes have taken place.

FRONTINO AND BOLIVIA (South American, Gold).—The directors have their usual advices from the mines, accompanied by a remittance of 528¾ ozs. of gold dust—produce of the mines for the month of March last. The mine reports are of a satisfactory character, and an improvement had taken place at the Maria Dama Mine. A profit is shown on the month's working of 32*l.* 8s. 8d.

ALMADA AND TIRITO (Silver).—Messrs. Cross and Co., of San Francisco, telegraph:—"Letters from Clemes to May 5 forwarded. Mine progressing favourably; yield of clear ore increased to 40 tons per week."

UNITED MEXICAN.—Guanaxuato, April 22: Mine of Jesus Maria y Jose: The works have been continued in this mine on a somewhat reduced scale, and as we have no new points of investigation, little can be said regarding the mine. The hacienda workmen are throwing down ore from the reserves. The buscones are at work as usual, though during the Easter holidays they have not done much. The sales have somewhat improved, being on April 7, $2003; 14th, $1749; and 21st, $1639.—Mine of Remedios: The Remedios workings still give an carga for the hacienda, but both quality and quantity have decreased, and the northward is not so promising, and upwards, though the ore continues, it is not so good in quality. The accounts for March show an excess of outlay over returns of $2686, but a raspa made is not included in them, and a torta came in on April 1, so that in April we may expect a profit. The sales have been on April 7, $899; 14th, $721; and 21st, $770.—New Concern, Adit of San Cayetano: The adit advanced in March 13 varas, the end is now 185 varas from the centre of Buenos Ayres shaft. We have cut through several small lodes, one of them looking pretty, though without silver, but I am of opinion that the main lode is yet untouched. The rock is firm, but not too hard, and we are getting on as fast as can be expected in a work so far advanced without any ventilation.—Mine of Buenos Ayres: The shaft on April 16 was 149½ metres deep, and in 10 days' time I expect to reach the depth requisite for opening towards the adit. We shall first have to drive a short cross-cut to the south, then I shall open eastwards towards the adit, and westwards towards the shaft of San Antonio de la Ovejera. By driving at both ends I hope to get through the 135 varas wanting in the adit by the end of the year.—Mine of San Antonio de la Ovejera: The shaft had reached 179 metres depth on April 16, and is also rapidly progressing towards a finish. To reach the level of the adit about 28 metres are wanting.

BRAGANZA (Gold).—Mr. W. H. Richards reports (April 30) as follows:—In the Tramway level, mentioned in my last, I at once saw that we had cut a lode 3 ft. big, we now find it to be 7 ft. thick, with occasional stratum of clay; this clay, however, contains small quartzose veins, so that the whole lode is auriferous, and will yield capital paying stone for the stamps. We find the gold contents, as well as we can extract them in our rough process, to be as near as possible 3 ozs. per ton. This is entirely a new lode to us, being 7 feet thick, and easily broken; it would be very rich even at 1 oz. per ton. From the "champion" nature of this lode, and its size, I consider this as the most important discovery we have yet made, and I have, therefore, requested Mr. Crewe to forward the following telegram:—"Intersected another lode, 7 ft. thick; gold contents according to sample, 3 ozs. per ton.—W. H. R." We know that we have still three lodes to intersect in that level, and should they continue to be as rich as we found them above we shall have an immense quantity of rich stone to extract from the backs. The sollar which we have been constructing for accumulating the ore is completed, and we shall now recommence operations on all our aureferous formations, so that in course of a few months there will be several hundreds of tons of ore for crushing. The deep adit has been widened the whole distance driven (say) 19 fathoms, and we shall now re-commence driving west, so as to intersect all the lodes we have met with above, and also to effect a communication with the upper tramroad level, and thus have a continuous tramway from the mine to the stamping-mills. We are making rapid progress with the stamping-mills, and I hope by the end of May to have them at work.

EXCHEQUER.—Capt. Chalmers, May 2: During the week ending Saturday, the 30th ult., a chamber was excavated at the bottom of air-shaft, 8 by 12 ft., and 7 ft. high, all ready for timbering. The winze was sunk 6 ft., so as to run the 50 ft. level as low as possible. My intention was that the floor of the drift should be at the 50, but on reconsideration I determined to sink 6 ft. further, thus making the 50 ft. from the top of the drift instead of the bottom. At the present time, but without any means of arriving at the exact amount, I should think we have out from 15,000 to 20,000 lbs. of all grades. I may mention that it is absolutely necessary to prevent loss that an ore-house be built at once, without which it is impossible to sort or judge accurately of what we have on hand. I have before submitted the necessity of providing accommodation for the men, and as the snow has almost disappeared I shall lose no time in proceeding with those erections. I am having five cuts, which have been made on the Acacia lode by the locators (and from which the ore specimens sent to London were taken), cleaned out, in accordance with mining regulations, and preparatory to a thorough investigation of the ledge.

PESTARENA UNITED (Gold).—T. Roberts, J. Mitchell, May 24: We are pleased to say that the so-called new lode reached, as mentioned in our last, in the cross-cut east at No. 2 level north is so far as seen a good size; the cross-cut has passed into its width, 4 feet, and has not reached the foot-wall as yet; we have made a small trial of some of the ore by one small mill, and find it to be satisfactory—other trials will be made this week; as soon as we have cut through the whole width of the lode in the level at this point we shall then be able to give you the average yield of gold per ton of ore. No. 1 stope in back of No. 2 level is not looking so well as last week, all other stopes in the north No. 3 level are without change.—Pestarena District, Aquavite Mine: Here we have an improvement in the end and driving south of cross-cut, at the adit level on No. 2 lode. The stopes in back of the 33 level yield 15 tons per fathom, worth 15 dwts. of gold per ton. The stopes in bottom of the 75 Peschiera yield 5 tons per fathom, worth 1¼ oz. of gold per ton.

NEW WILDBERG.—J. Sanders, May 27: East Mine: The drivage east at the Erbstollen is at present yielding 1¼ ton, at the stope above the level 1¼ ton per lachter.—Carter's Shaft: The Erbstollenenstrang Erzkammer at the 70 remains as last week, the stope in the forebreast worth 1 ton of ore per lachter.—60 Lachter Level: The stope above the level towards Johanne's sink remains as last week, worth 2 tons per lachter.—50 Lachter Level: The pitches above the level on Dornergang Erzkammer, and other places in this part of the mine, are yielding 1 ton of ore per lachter.—Beck's Workings: The cross-cut north at the 70, appears to be through the lode, and as no ore has been met with it is suspended. There is no change to notice in the tribute pitches.—East Bluemengang: The stopes in this part of the mine are without any change to notice, the one above the 70 is worth 2½, and that between the 70 and 60 worth 2 tons per lachter. The drivage west, at the 60, is composed of grauwacke, quartz, and schiefer, with strings and spots of lead ore, and has the appearance of shortly improving.—West Bluemengang: The drivage east, at the 60, is quite so good as last week, present value 2 tons per lachter.

[For remainder of Foreign Mines see to-day's Journal.]

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